



First Looks:
Logitech's New
ScanMan Connects
To the Parallel Port

First Looks:
CommWorks, a 5-in-1
Communications
Bargain at \$200

Printer Extravaganza

PC LABS TESTS
105
PRINTERS

HP DESKJET
1200C/PS

10th
ANNUAL
ISSUE

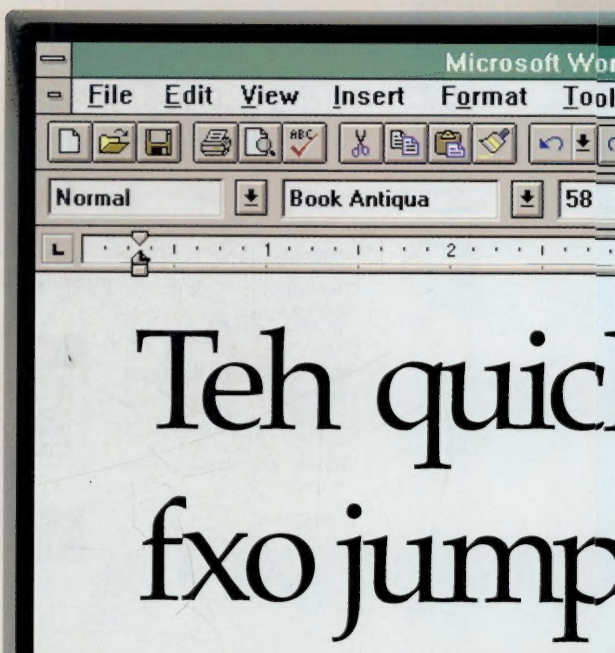
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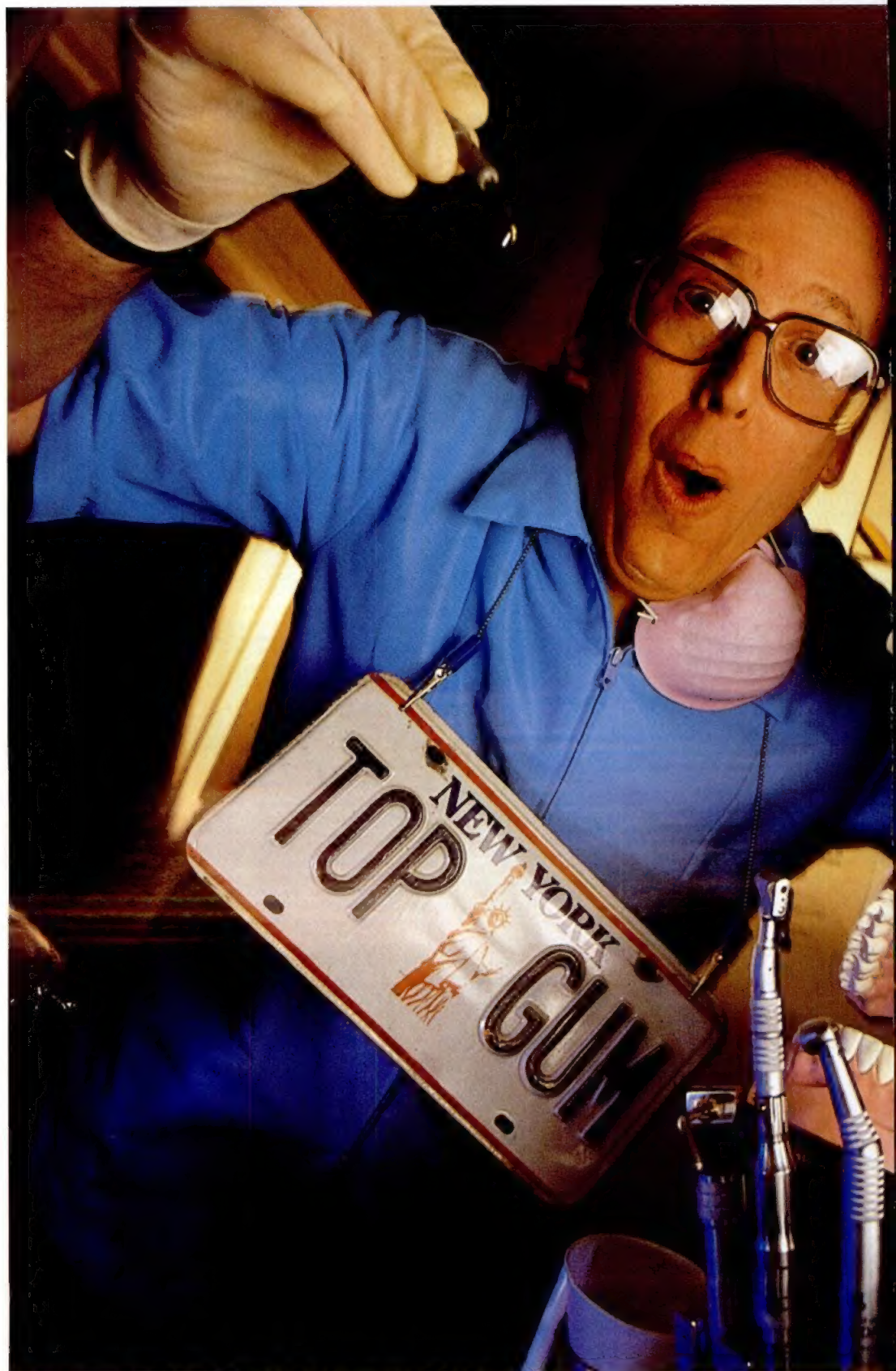
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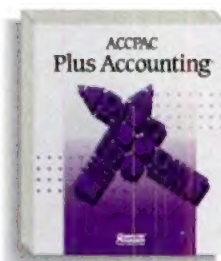
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Inside

Once again, we present the only issue of *PC Magazine* devoted entirely to one topic: our annual printer extravaganza. We have found more than 100 printers deserving of attention this year and our intrepid Hardware Team has managed

to squeeze the most pertinent facts about each one into a cogent, useful package.

This massive undertaking, which exemplifies *PC Magazine's* commitment to comprehensive coverage, was managed by Leon Erlanger, our associate editor in charge of the Hardware team. His group, which includes PC Labs project leader Michael Zulich, staff editor John Clyman, technical analyst Margaret Piemonte, and researcher Mary Behr, began working on the annual printer project back in May when Erlanger joined the magazine. He was well prepared for his new position, having managed large review projects for Computer Buyers' Guide and Handbook. Here, the task was complicated by the extensive testing

stream. The price points for first-rate color are rapidly dropping down to the purse of the average buyer. Two, inexpensive black-and-white laser printers have become a standard, outselling the 8-page-per-minute printers.

It's a wonder Erlanger has time to notice *any* trends. During the controlled chaos that charac-



From left: Piemonte, Behr, Erlanger, and Clyman

that each product had to undergo. But the Hardware team managed to get it all done on time, and we think we have an issue you'll want to keep around.

Erlanger came away from the printer project with a couple of interesting observations. One, color is pushing into the main-

terizes a printer issue, he found time to get married, take a short honeymoon, and to overcome the loss of two staff members to graduate school. Is he planning to resume that honeymoon? No way, says Erlanger, who has another big project under way.

—Joel Dreyfuss

PC Magazine: The Independent Guide to Personal Computing. ISSN #0888-8507 is published biweekly except in July and August for \$44.97 for one year. Ziff-Davis Publishing Company, L.P., One Park Ave., New York, NY 10016. Second-class postage paid at New York, NY 10016 and at additional mailing offices. POSTMASTER: Address changes to PC Magazine, P.O. Box 54093, Boulder, CO 80321-4093. GST Registration Number: R-123669673. Canada Post

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Printers

10th Annual Printer Issue

BY BILL HOWARD

The \$500 laser printer is a reality. High-quality color doesn't have to be expensive. Output is improving, especially among the new low-cost ink jet printers. Footprints are shrinking, even as powerful new features are being added. These are just a few of the developments we noted when testing the 105 laser, ink jet, dot matrix, and high-end color printers we review here108



Prices continue to drop as the number of features multiply.

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Mainstream Lasers

Improving on Strengths

BY ALFRED POOR Mainstream laser printers look better than ever, with lower prices, smaller footprints, more features, and better performance. We review 37 laser printers rated for less than 12 pages per minute and discuss the results of our tests of speed, compatibility, print quality, and power consumption.125

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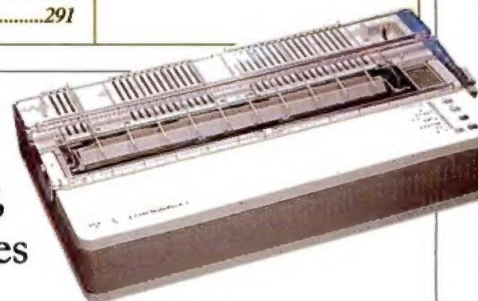
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Old Technology, New Choices

BY OLIVER RIST

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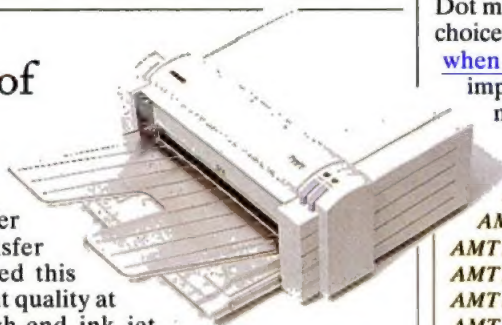


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A Spectrum of Possibilities

BY M. DAVID STONE

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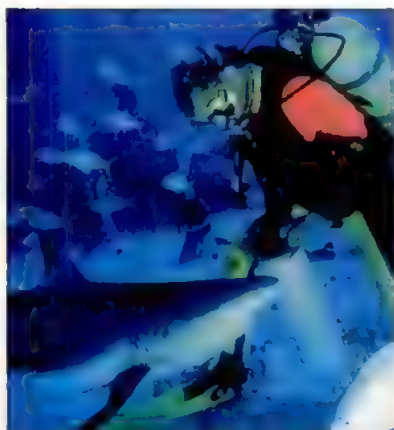
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Subscription Rate: The subscription rate is \$44.97 for a one-year subscription (22 issues). Canada and all other countries, please add \$36.00 for postage.

Back Issues: For back issues (subject to availability), \$8 per issue (\$9 outside the U.S.), send check or money order to Back Issues Dept., Ziff-Davis Publishing Company, P.O. Box 53131, Boulder, CO 80322-3131.

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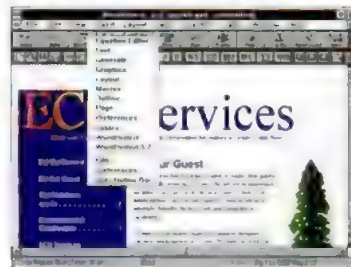
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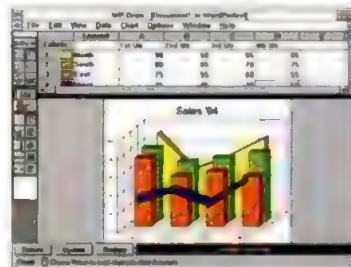
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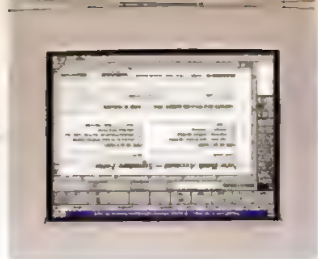
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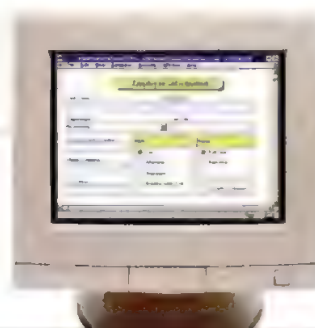
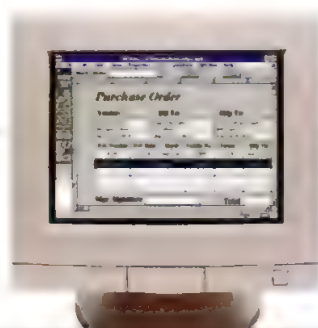


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Letters

BOTTOM LINE ON VALUE LINES

The "Value-Line PCs: Family Values" review (September 28, 1993) was enlightening. It's very important to compare system configurations that are either functionally exactly the same or else very close. Otherwise price differences don't mean much. What surprised me the most was how competitive the price of the IBM PS/ValuePoint computers are. I'd also suggest one should examine the manuals that come with the computer and maybe try calling technical support with some test questions before deciding which system to buy.

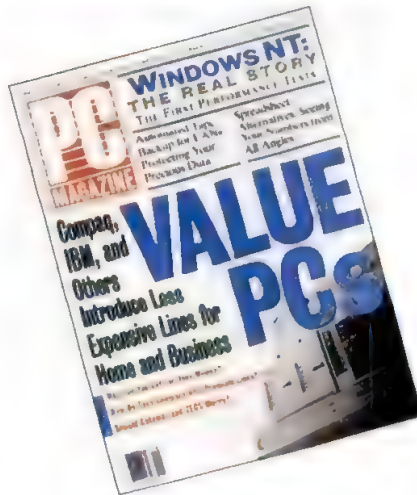
Stan Logue
San Diego, California

Your Value-Line PCs article compared apples to oranges! Countless bargain hunters would have appreciated seeing how Gateway stacks up against Dell and Zeos. Yet you selected only Gateway 33-MHz systems and Dell 66-MHz systems. How can I draw any conclusions from that? It's also misleading to refer to the affordable Gateway 4DX/33 as a "Windows nonperformer" when comparing it to 13 DX2/66 systems costing 50 to 100 percent more! Why not provide us with a more useful frame of reference that would help in future decisions?

Mark Stang
Durham, North Carolina

The ergonomics and practicality of a system's design is an important feature that is often overlooked in computer reviews. The Value-Line PC story is a case in point: both the Dell 486/66 on page 147 and the Zeos 486DX2/66 on page 178 feature cases with hard-to-reach disk drives, yet the review makes no mention of this. Although most users today make frequent use of 3.5-inch diskettes, many PC designs place this primary drive in an awkward location that is either difficult to access or completely blocked by the keyboard, especially when it is used on smaller desks. It would be helpful if reviews took note of such design flaws.

Henry C. Gernhardt, Jr.
Parkersburg, West Virginia



The ergonomics and practicality of a system's design is important.

NT, OR NOT NT?

I don't think your review of Windows NT ("Windows NT: See How It Runs," September 28, 1993) was at all useful. After all, how many users have computers with two Pentium processors and 32 megabytes of RAM? Your attempt to use infinite computing resources to somehow make NT look much better than it really is does the readers a great disservice.

Luke Chen
Claremont, California

The Windows NT review in the September 28 issue was well worth reading. I hope that there is now no doubt that 32-bit computing is better than 16-bit computing. I found the most interesting point made in the article to be that Windows NT is a better Unix than Unix. I'm so glad to see PC operating systems moving up (almost) to the workstation level.

Stephen Deng
Diamond Bar, California

A few comments about the September 28 Windows NT review, which compared performance between NT and OS/2 2.1. You stated that you installed accelerated drivers for all the operating systems except OS/2, for which you installed stan-

dard VGA drivers. If you had installed the 8514/a drivers, which are somewhat accelerated, you'd likely have experienced faster results than under the default VGA drivers.

On the other hand, I felt that the basic conclusion—that NT and OS/2 are comparable—was a good evaluation. NT is not yet ready to fight it out with Unix. The lack of a serious command line will kill NT's potential in the eyes of most of the Unix system administrators I know.

Tom Branham
Wellesley, Massachusetts

On the whole, your article on NT was very good, with this one exception: You never mentioned that you were comparing Windows NT and OS/2 in NT's hardware environment. There was no mention that OS/2 runs well with one quarter the memory and at one third the cost of the hardware platforms you used.

Alan Scott
Via PC MagNet

TESTING MODEMS, TAKE TWO

With regard to the "Life in the Fast Lane" roundup of V.32bis modems in the June 29, 1993 issue, we have confirmed that with different strap settings than those supplied to you, the same Racal-Datcom ALM 3226 modem as the ones reviewed performed significantly better than what your test results reported.

Maria Hernandez
Product Manager, Racal-Datcom
Sunrise, Florida

• Using the strap settings that Racal-Datcom submitted after the review was published, we retested the ALM 3226 modem. It worked remarkably better, finishing all tests with no trouble.

The following retested performance numbers for the ALM 3226 correspond to the test results in the June 29 review. For the Protocol Throughput test on page 251, the numbers would be 4,591 cps for unidirectional and 3,560 cps for bidirectional throughput; on page 254, the Protocol Ratio for the ALM 3226 would be 0.86 and the Data Pump Ratio would

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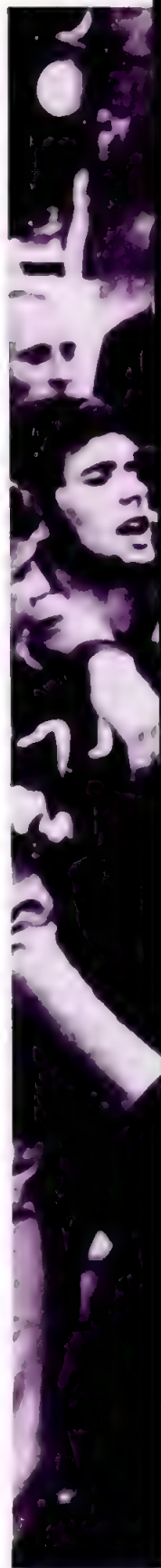
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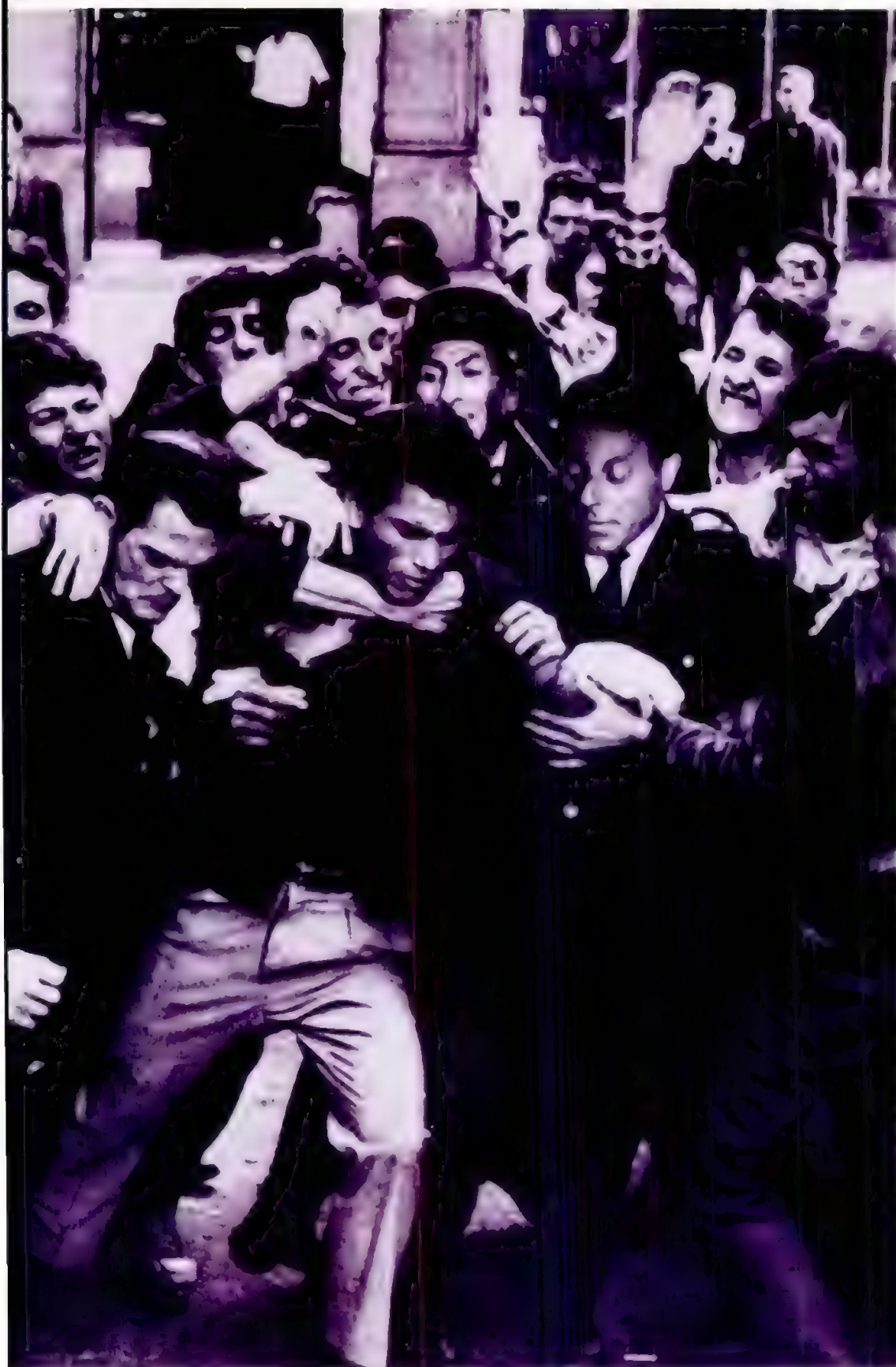


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LETTERS

be 0.92. If Racal-Datacom had supplied these strap settings during our original tests, the modem would have finished about 25th (out of a field of 62). We could not, however, retest the unit's interoperability.—Ed.

REVENGE OF THE DINOSAURS

I take exception to Michael J. Miller's September 14 column, "Yet Another Dinosaur?" Several computer periodicals have referred to the one line spoken by 12-year-old Lex from *Jurassic Park* that Mr. Miller cites in his piece. However, though this is a fictional occurrence of a young person having proficiency with the Unix operating system, Mr. Miller should not be so quick to ask, "Are they kidding?" Someone just may answer, "No, they're not."

The fact of the matter is that MS-DOS is dead and Microsoft Windows has a terminal case of proprietary design. Bill Gates can claim NT has Unix compatibility or Unix-like operation all he wants. I can always claim my Ford Escort runs just like a Lamborghini Countach, but that doesn't make it so.

Matthew Garrett
Terre Haute, Indiana

LOOKING THROUGH AND PAST WINDOWS

I was a little miffed at Michael J. Miller's intimation in his column, "Stuck Inside Those Windows Blues," (September 28, 1993) that the Windows/DOS user will be neither ready nor willing to use OS/2, Windows NT, or the Unix alternatives. Computer users could stand the emergence of another operating system, and one that is not in the form of NT or Unix.

I feel Mr. Miller is doing his readers a disservice by stating that, in spite of the difficulties presently plaguing 32-bit systems, "Now, I will put up with this . . . because I want to use the advanced systems. But I don't expect the average end user to do so." Does this mean the rest of us should settle for anything less, while others continuing pursuing the most advanced systems possible?

Karin and Peter Chant
Port Coquitlam, B.C., Canada

Mr. Miller's column, "Stuck Inside Those Windows Blues," certainly had a familiar resonance. I have been using OS/2 since the introduction of Version 2.0 and am pleased overall. The new version promised to correct the few shortcomings in Version 2.0, and I expectantly awaited the bug-fixing upgrade. Only now I find myself dealing with a whole new set of bugs.

I.F. Yusif
Tuckerton, New Jersey

*Bill Gates can claim
NT has Unix compatibility
all he wants. I can
always claim my Ford
Escort runs like a
Lamborghini, but that
doesn't make it so.*

GUI COMMERCIALS: MACWINDOWS?

The Sprite soda commercial that "looks just like Windows" (Trends, September 28, 1993) has file folders, a junk can, and a lemon on the menu bar. I am amazed at how the advertisers were able to make Windows look so much like the Macintosh.

Art Sawyer
New York, New York

DOS A BETTER FILE MANAGER

In your review of the new Norton Commander, Version 4.0 (First Looks, September 28, 1993), I found one particular comment dismaying. You say that "Windows beats DOS hands down when it comes to manipulating files." A power user wants to do the job fast and without too many hassles. When it comes to power file management, the Windows environment requires the help of too many additional utilities, and even then it falls short of what the DOS-based Norton Commander can provide. Hands down, Commander 4.0 wins for fast and powerful file management capabilities.

Vincent Veenstra
Monnickendam, The Netherlands

WIDENING THE VIEW OF MONITOR STANDARDS

In your September 14, 1993 article on "17-Inch Monitors: A Wider View," you reported on ELF emission testing for 17-inch color monitors. As is regularly the case, emissions were measured to the MPRII guidelines and not to other standards that currently exist. The Swedish Labour Confederation (TCO), the New York Board of Education, the U.S. National Foundation for Cancer Research, and the Canadian Association for Safe Computing all follow guidelines that cite 2.0 milligauss at 30 cm from the screen as the measurement standard, as compared with MPRII's 2.5 milligauss at 50 cm from the screen.

Adoption of the 2.0 milligauss at 30 cm guideline means that computer users will be exposed to much less ELF emission. It could be helpful for readers to have reports in both standards, so as to best determine which monitors pass the health standards test.

Ann Dow
Red Deer, Alberta, Canada

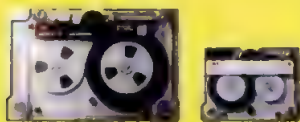
VISUAL C++ SURPRISE, TAKE TWO!

In a September 28, 1993 letter to the editor, a developer discussed the problems he has been having installing Microsoft's Visual C++ under DR DOS 6.0. Well, I have discovered that this problem also extends to OS/2, where Visual C++ also cannot be installed. Microsoft claims that OS/2's Windows Compatibility mode is not as good as the 'real' Windows, but I see it as being a case of irony in that IBM is finally reverting from the closed architecture mentality that nearly ruined it while Microsoft is heading down that path with gusto.

Sol Fried
Brooklyn, New York

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TECHNOLOGY WITH A CONSCIENCE.

*All comparisons based on InfoCorp values. 5% average page coverage. "high-volume" = 16,500 pages/month. Retail prices (8/93)/InfoCorp yields used for calculations: HP 4Si cartridge—\$169/8,000 pages, Compaq 15 cartridge—\$269/12,000 pages, Lexmark 16L cartridge—\$269/12,800 pages. To calculate: Cartridge price ÷ yield = 5% = cost-per-page, cost-per-page x total annual volume = annual cartridge expense.

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Trends

TRENDS & TECHNOLOGY SHAPING THE PERSONAL COMPUTER MARKET

Digital Privacy

Who has the right to read your data?

The Constitution guarantees you freedom of speech, but does it guarantee you freedom of *encrypted* speech? The issues of data privacy and data encryption—a method of scrambling digital data to thwart snoopers—have taken on political urgency now that the

Clinton administration is busy promoting the information superhighway and technology is propelling us into a vast networked future.

The Clipper encryption chip, the Administration's answer both to the individual's concern for data security and to the government's concern for law enforcement, is poised to challenge the current de facto standards—

DES and RSA. These are software-based encryption programs that are now used in Lotus Notes, NetWare, and other apps.

Clipper's 80-bit algorithm—Skip-Jack—has two 40-bit decoder keys that developers of products with encryption are required to place in escrow with two government agencies. These agencies could then be authorized to hand the keys over to law-enforcement agencies if they could show probable cause that someone is committing a crime.

Announced by President Clinton in April, Clipper is seen by its proponents as striking a balance between individual privacy and law enforcement by providing law-abiding citizens with access to the encryption

they need and preventing criminals from using it to hide criminal activity.

The opposition argues that the *key escrow* system is a built-in back door that smacks of desktop surveillance. The government eavesdropped on 1.35 million conversations in 1991 and made 3,000 arrests as a result of court-authorized intercepts, according to a study by Computer Professionals for Social Responsibility.

Clipper has fueled criticism from many computer companies and from watchdog groups such as the Electronic Frontier

Foundation and CPSR, which point to two main shortcomings. First, the key escrow system undermines individuals' right to privacy. Second, the technology behind the Skip-Jack algorithm developed by the National Security Agency is secret.

Should you be worried about digital security? "Encryption absolutely affects individuals," says Daniel Weitzner, senior staff counsel at EFF. "It matters for people who send proprietary data over multiple networks and for people who send electronic mail. And it matters enormously for on-line business where

encryption is the only way to protect intellectual property."

Though adoption of Clipper is voluntary, plans for implementing it on modems and phones are moving forward. Meanwhile, the debate continues over the societal costs and/or benefits of Clipper. Dorothy Denning, professor of computer science at Georgetown University and one of the few reviewers of SkipJack, says Clipper will afford individuals greater privacy and protection against industrial espionage. But CPSR's Marc Rotenberg asks, "Is it right for the government to put a cap on how much privacy individuals can have?"—Carol Levin

Exporting Technology

WHILE THE CONTROVERSY BREWING over the Clipper encryption chip focuses on individual privacy, the privacy issue extends far beyond the borders of your desktop to the global arena.

Software that includes *strong encryption* is subject to strict export controls in order to minimize the spread of technology that could undermine the government's ability to gather intelligence. In fact, cryptography is included on the State Department's list of weapons that could compromise the country's security.

Despite attempts to keep the technology stateside, 84 products that employ the Digital Encryption Standard (DES) are available overseas, says the Software Publishers Association. But the regulation has succeeded in keeping U.S. companies out of the global marketplace. And recently, the makers of a software encryption program called Pretty Good Privacy (PGP) have been investigated for possible export violations. (Both DES and PGP are available on the Internet.)

The American Civil Liberties Union has questioned the rule's constitutionality. "We think it's a violation of the First Amendment for the government to say you can't export those products because computer software is a form of speech that's given special protection," says Kate Martin, director of the ACLU's Center for National Security Studies.—Carol Levin



Pipeline By Robin Raskin

A Coupon for Your Thoughts

Suppose I told you that the staff here at *PC Magazine* was slipping up in production schedules and would be unable to ship an issue this month. You know how it is: too many trade shows, complicated testing, products that nearly miss our testing deadlines....Not to worry, though. We'll ship you a *coupon* for the issue instead! This coupon guarantees that you'll receive the tardy issue the instant we can get it ready.

If this scenario rubs you the wrong way, then you'd better keep your antennas up, because software vendors are starting to adopt the "coupon" strategy.



The most recent offenders are IBM PC-DOS 6.1 and the latest version of Microsoft's application bundle, Microsoft Office. While Microsoft was taking the heat for DoubleSpace and Stacker was getting in up to its neck in legal tussles, IBM wrestled with which compression technology to bundle with its release of DOS 6.1. The debate went on so long that IBM decided to ship the product without compression. Instead, the software includes a coupon for a compression product.

Microsoft bests IBM by offering not one, but two coupons. The first copies of the \$750 Microsoft Office will include Word for Windows 6.0, Excel 4.0, PowerPoint 3.0, and Microsoft Mail. There will also be two coupons in the box: one for Excel 5.0,

which will be ready momentarily, and one for PowerPoint 4.0, which will ship early next year.

Registered users will receive the upgrades absolutely free. Not to be outdone, Borland recently announced that it would ship Borland Office for Windows with...you guessed it, a coupon for the new versions of WordPerfect 6.0 for Windows and Paradox for Windows. My personal favorite is the coupon accompanying the CD-ROM included with every IBM Ambra machine. Ambra hopes the shiny CD platter is enticing enough for you to cash in the coupon and buy a CD-ROM drive.

There are two ways to look at the coupon phenomenon. On the one hand, you may feel that you're buying vapor when you get coupons in lieu of products. Who knows whether you'll even like IBM's compression or PowerPoint 4.0? Who knows whether you'll actually receive the program? Suddenly, you're forced to be vigilant about yet another detail of your computing life—tracking coupons.

On the other hand, why live without a perfectly good upgrade for months while you wait for some of the pieces? After all, a coupon for a stable product is preferable to being a bug hunter forced to beta test some half-baked software.

If the industry adopts the coupon mentality, we're in for trouble. Tracking coupons would be one more computer nightmare. And yet vendors seem to be latching on to the concept as a way to cope with frantically paced product cycles. Can you live with coupons? Drop us a line (CompuServe ID: 72241,12; MCI ID: 374-1474) and let us know. We'll give you a coupon for your thoughts.

Robin Raskin is an executive editor of PC Magazine.

Wired Woodstock

THE ENTERTAINMENT BUSINESS has jumped on the multimedia bandwagon faster than most industries, bringing new computer technologies, digital cameras, software, and video techniques to concerts and entertainment events. So while you may be struggling to bring multimedia software and hardware into the office, you may find that your kids are exposed to it long before you.

Take the WOMAD (World of Music, Arts and Dance) festival as an example. Founded over ten years ago by musician Peter Gabriel to give exposure to international artists, it's become a beacon of high technology.

FutureZone, a high-tech mecca showcasing interactive displays from a number of computer companies including Apple and Sun Microsystems, was featured recently at the WOMAD festival held in San Francisco.

Inside FutureZone—located not far from the kiosks promoting GreenPeace and smart drinks—were a number of areas

where the more than 100,000 festival goers could experience technology firsthand. Broderbund Software had a Kid Cuts display where children used computers to create colorful masks to wear at the concert. A number of CD-ROM companies displayed their interactive titles, including a forthcoming interactive CD from Gabriel that combines art along with his music, and takes you backstage. Unlike an audio CD that plays only music, an interactive CD requires a computer and a mouse to navigate.

Brett Leonard, who directed the virtual-reality-inspired movie *Lawnmower Man*, and a team of videographers circulated among the crowd and shot videos with Sharp Viewcams. The footage was then incorporated into real-time music videos. Concert goers were also invited to experiment with image-editing software and to lend some of their own artistic talents to Leonard's Blendo Video. And more than a dozen pro-

fessional photographers equipped with the latest in digital cameras encouraged attendees to take self-portraits, which were then printed and placed onto a "digital billboard."

Festival goers, who appeared to be in



Music and multimedia at San Francisco's WOMAD festival.

their early twenties for the most part, were encouraged to explore, interact with, and experience FutureZone's high-tech tools. It wasn't a bad concert, either.

—Christopher Barr

Top Retail Software

Current ranking	Last issue	Product/company
1	5	Procomm Plus for Windows 1.02 Datastorm Technologies
2	—	Excel 4.0 for Windows Upgrade Kit Microsoft Corp.
3	1	Microsoft Windows 3.1 Microsoft Corp.
4	—	Quattro Pro 5.0 for DOS Borland International
5	2	Microsoft Publisher 2.0 Microsoft Corp.
6	9	Microsoft Office for Windows 3.0 Microsoft Corp.
7	12	QuickBooks 2.0 for Windows Intuit
8	6	Quattro Pro 5.0 for Windows Borland International
9	—	Microsoft Profit 1.0 for Windows Microsoft Corp.
10	4	Lotus 1-2-3, Release 4 for Windows Upgrade Kit Lotus Development Corp.
11	7	QEMM 7.0 Quarterdeck Office Systems
12	14	Access for Windows 1.1 Upgrade Kit Microsoft Corp.
13	8	WordPerfect 6.0 for DOS Upgrade Kit WordPerfect Corp.
14	—	CorelDRAW 3 Corel Corp.
15	—	Lotus 1-2-3, Release 4 for Windows Lotus Development Corp.

This list ranks PC business programs according to the total number of copies shipped to stores and resellers in the week ending September 18, 1993. The list is based on shipments to more than 12,000 retail locations. It does not include sales made directly by software publishers and cannot be interpreted as a picture of the entire software market. Sales information compiled by Ingram-Micro.

Faster IDE Drives

AN UNWRITTEN LAW SAYS THAT no matter what the size of your hard disk, you'll have only 10 percent free at any time. What may help is a new specification that will enable bigger and faster IDE drives, as well as IDE CD-ROMs and tape drives.

Most PCs contain an IDE (integrated drive electronics) disk drive because IDEs are inexpensive and reliable. SCSI (small computer systems interface) technology is preferred for higher-capacity systems. Now

a new specification called enhanced IDE, or fast IDE, should boost IDE drives to SCSI capabilities.

SCSI drives are desirable because they can hold more data and have greater throughput than IDE drives. And you can daisy-chain up to seven SCSI devices, including tape drives and CD-ROM drives, on a single controller—something ordinary IDE can't do. IDE drives, however, cost less than SCSI drives. Now the new enhanced IDE drives will support up to four IDE devices (which could include an IDE CD-ROM and an IDE tape drive) on a single controller.

Enhanced IDE also boosts data transfer rates from an average of 2 to 3 megabytes per second to approximately 9 to 13 MBps over a local bus, which is comparable to the rate specified with SCSI-2. New controllers required to run the enhanced IDE drives will support both VESA and PCI local-bus architectures. A proposal to push IDE's 528MB limit to 8.4 gigabytes is also on the table.

The first enhanced IDE drives larger than 528MB were shipped recently by Conner Peripherals and Western Digital. Enhanced IDE will be adopted by all the major disk drive makers, including IBM, Quantum, and Seagate, as early as 1994.

—Christopher Barr

Catch A Wavetable

SOUND BOARDS ARE SOUNDING far more realistic than they used to, thanks to a technology called wavetable synthesis.

Most sound boards generate sounds using FM synthesis, a technology first pioneered in 1976. By using one sine wave operator to modify another, FM synthesis creates an artificial sound that mimics an instrument. Over the years, the technology has progressed (some FM synthesizers now use four operators) to a point where FM synthesis sounds good, but it still sounds artificial.

More realistic, inexpensive sound was pioneered by Ensoniq Corp., the makers of professional keyboards, in 1984. Using a technology that had been theorized at about the same time as FM synthesis, Ensoniq found a way to sample any instrument, in-

cluding pianos, violins, guitars, flutes, trumpets, drums, and to store the digitized sound in a wavetable. Stored either in ROM chips or on disk, the wavetable supplies an actual digitized sound of an instrument when called by the application. Soon after Ensoniq's discovery, other keyboard makers such as E-mu, Korg, and Yamaha replaced their FM synthesizers with wavetable synthesis.

Albert Charpentier, Ensoniq's chief technical officer, believes all sound cards will use wavetable synthesis in the future. "The sound board business trails the professional music market by a few years. Professional musicians used FM synthesis keyboards in 1982, wavetable synthesis in 1986, and wavetable synthesis with effects in 1989. Wavetable synthesis boards are finally replacing FM synthesis in the sound board market. No professional musician would settle for anything less," says Charpentier.

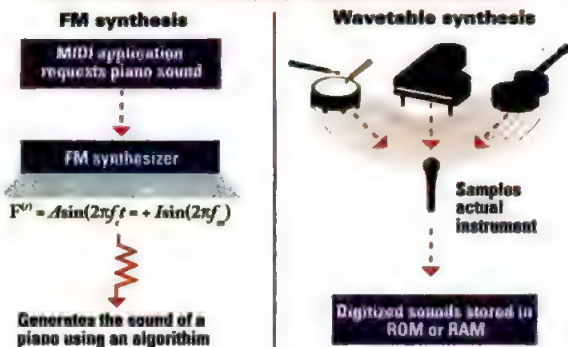
Although Yamaha virtually owned the chip market for FM synthesis, a number of professional keyboard makers with years of experience working with digitized sounds have wavetable chipsets that are beginning to appear in sound boards. Creative Labs' WaveBlaster uses E-mu's chip, and Media Vision's Pro AudioStudio 16XL, due by the end of the year, will use Korg's. Yamaha's new OPL4 chip, due later this year, will be able to create both FM synthesis and wavetable synthesis sounds. Yamaha expects the boards to cost less than \$300.

Sound boards that offer wavetable synthesis using chipsets from other vendors include Diamond's SonicSound, Advanced Gravis's UltraSound, Orchid's SoundWave 32, and Turtle Beach's MultiSound.

Wavetable synthesis won't make every sound on your PC more realistic—only the MIDI sounds, which are often used in games. Windows .WAV files are actual stored sounds, and don't benefit from wavetable synthesis.

—Christopher Barr

How Sound Boards Generate Music



The Eternal 386

NEW MICROPROCESSORS WITH slick names like OverDrive, Pentium, and Blue Lightning have eclipsed the power of the 386, but it looks like the 386 isn't destined to follow the 286 into obscurity. Instead, the 386 processor is finding a new life in what's known as *embedded systems*—home and office appliances that have been fitted with processors.

Embedded systems get little or no attention simply because they use old chips, but tens of millions of processors are sold annually into the embedded systems market. Today you'll find processors in just about every modern convenience from cars to modems.

In the early eighties, the 8-bit Z-80 was the embedded CPU of choice; now the preferred chip is Intel's 80186 or Motorola's chips. One of the reasons that Intel chips are preferred is the recent proliferation of x86 programming tools; the other reason is the widespread acceptance of Windows.

General Instruments and Intel have already announced plans to use a 386 in a cable-TV set-top decoder. In this case, the purpose of the 386 is to handle the user interface, which we expect will be some type of graphical menu that lets you scroll through program listings.

Later this year, 386 chips will be used in scanners, network cards, bar code readers, cellular phones, and telephone switches. Evangelizing its Microsoft-At-Work strategy (see Trends, September 14, 1993), Microsoft is making deals that call for 386 chips copy and fax machines. It won't be too much longer before we see a 386 chip built into a microwave or toaster oven. We'll probably dub that Microsoft-At-Lunch.

—Christopher Barr

New Video Chip

POSTAGE STAMP-SIZE VIDEO CLIPS are state of the art for PC-based video. Try blowing up the video window and the image becomes pixelated, the sound and motion lose synchronization, and the image becomes jerky. Newcomer AuraVision has developed a chip that tackles these problems.

Designed with multiple internal video caches, data compression, and video acceleration, the VxP500 processor integrates functions that used to be handled by an

HOW DOES THE NEW TAX BILL AFFECT

you? Get a jump start on tax prep for 1993—with the fall editions of Intuit's Quicken Companion 2.0, ChipSoft's TurboTax Tax Planner, or MECA Software's Tax Cut, Headstart edition.

THE COST OF ON-LINE SERVICES HAS IN-

creased for New York state residents, who must now pay an extra sales tax of 5 percent for "entertainment" (that includes CompuServe, Prodigy, and BBS services) delivered over phone lines.

MOVE OVER, JANE FONDA. PERSONAL

training has come to the PC. You can now create your own customized exercise video on CD-ROM with Fitness Partner, from Computer Directions. Set your goals, age, gender, and fitness level, make a music selection (country western, jazz, or rock), and choose the areas you

entire board. It records, captures, and plays back video at 30-frames-per second at any size you choose. Priced around \$400, boards using the VxP500 will be available from Orchid Technology and others by the end of the year.—Carol Levin

PC Execs Educate Congress

HOW FAR HAS WASHINGTON TRAVELED the nation's information superhighway since the High Performance Computing Act was introduced in the winter of 1991 by then-Senator Al Gore? Based on the number of bills that have flooded Congress this year and the Administration's recent creation of the National Information Infrastructure (NII) task force, progress is clearly being made.

Legislators are now considering a dozen bills that address issues such as high-bandwidth communications, telecommunications, and information access. And in order to formulate sound, forward-looking policies, they're turning to key players in the computer industry to help them brush up on the technology behind issues such as upgrading the Internet backbone, delivering video over the phone, and setting multimedia standards for education.

Briefs

need to tone up. The CD-ROM includes 75 full-motion video clips of an aerobics instructor so you can crank up the workout as you improve.

WHILE CHINA CRACKS DOWN ON THE

spread of mobile phones, pagers, e-mail programs, and electronic information services, Compaq is opening its first office in China. Apple, AST, and IBM have plans to expand into China as well. And Congress has taken a first step in easing trade restrictions on the sale of telecommunications and computers to China.

IS YOUR KID A COUCH POTATO? THEN GET

a PC. A recent study by Fuji finds that children ages 6 to 17 watch less TV when there's a computer in the home. More than half the parents surveyed say kids should start using computers before the age of six.—Carol Levin

Computer companies, public policy groups, lobbyists, and trade associations have met informally with members of Congress, their staffs, and Administration officials to offer insights and share their vision of the future. Industry executives have also testified before Congress on such topics as R&D funding, interoperability, information access, and competition. "Computer companies have helped us understand how important open systems are, the potential dangers of closed systems, and how their experiences may be applied to video software and HDTV," says an aide for Rep. Edward Markey (D-Mass.), chairman of the House Subcommittee on Telecommunications and Finance.

Apple Computer, Digital Equipment Corp., Hewlett-Packard Co., IBM, Lotus Development Corp., and Sun Microsystems are reviewing the details of forthcoming bills with legislators. Digital, for example, has briefed policy makers on the role of information technology in the health care system.

"NII is the culmination of the effort to educate the Bush and Clinton Administrations regarding technology issues," comments Michael Aisenberg, manager of federal relations/legislative counsel for Digital Equipment Corp. "The Clinton Administration is much more savvy than past administrations in terms of technology."

—Melissa J. Perenson

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STANDARD WITH EVERY ZEOS CONTENDA

- 25MHz 80386SL or 80486SL Intel CPU.
- RAM expandable to 8MB for 486SL, 10MB for 386SL.
- IDE hard drive up to 120MB.
- Display: 640 x 480 VGA backlit, .23 dot pitch, Sharp 74" diagonal,
up to 64 shades of gray.
- 256K (386SL version) or 512K (486SL version) video RAM.
- 486SL version includes 3.3v technology for added battery life,
PI local bus for Windows acceleration, high-speed floppy drive
controller, built-in math coprocessor.
- Supports simultaneous display with an external SVGA
color monitor.
- Replaceable and rechargeable NiMH battery.
- 80-key keyboard with embedded numeric keypad and easy-to-use
built-in trackball.
- Serial, parallel and video ports, plus ports for optional internal
fax modem and external floppy drive.
- Fully-featured power management.
- 9.7" x 6.1"; 3.9 lbs.
- FCC Certified Class B.
- Complete ZEOS Customer Satisfaction Package.

PACKAGE 1

386SL Contenda: \$1195

Lease \$50/month

486SL Contenda: \$1495

Lease \$63/month

- 2MB RAM (386SL); 4MB RAM (486SL)
- 80MB IDE hard drive

PACKAGE 2

386SL Contenda: \$1495

Lease \$63/month

486SL Contenda: \$1795

Lease \$65/month

- 4MB RAM
- 80MB IDE hard drive
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386SL Contenda: \$1795

Lease \$65/month

486SL Contenda: \$2195

Lease \$79/month

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- Custom leather carrying case
- Extra battery
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- Microsoft DOS and Windows. Plus Lotus Organizer.

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Maximum Resolution	600 x 600 dots per inch	300 x 300 dots per inch
Rated Engine Speed	10 pages per minute	5 pages per minute
PostScript® Emulation	Standard	Optional
Resident Fonts	74	15
List Price	\$1675	\$2199

*LSX1000 comes with a 3 year limited warranty

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CIRCLE 306 ON READER SERVICE CARD

First Looks

HANDS-ON EVALUATIONS OF THE NEWEST SHIPPING PRODUCTS

■ Can Multimedia Presentations Ever Be Easy?

Premiere and MediaMerge Turn You into a Video Editor

BY LUISA SIMONE

With the introductions of Adobe Premiere 1.0 (\$295) and the MediaMerge 1.0 from ATI (\$299), video editing on the PC just got easier and cheaper. Both programs reflect the increasing sophistication of multimedia under Windows.

New compression technologies play a major role in both products by providing digitized video files that occupy less disk space, play faster, and look better. Both Premiere and MediaMerge can handle a variety of CODECs (Compressor/ DE-Compressor), including Intel's

Indeo and SuperMatch's Cinepak formats.

In addition, both import the standard suite of multimedia file formats, including the Microsoft Video for Windows (.AVI), QuickTime movies (.MOV), and Wave sound files (.WAV). And both support Autodesk animation files (.FLC or .FLI) and ordinary bitmapped pictures in .BMP, .PCX, or TIFF format.

Both Premiere and MediaMerge are built upon common technology and established tech-



MEDIAMERGE: Scene Editor gives feedback.

niques. Both use drag-and-drop functions to insert video clips into the workspace or to drag the edge of a video clip in order to change

its duration. In theory, the basic editing techniques are similar in the two programs. Various tools let you slice, splice, sequence, and composite (or overlay) audio and video clips. But in practice, Premiere and MediaMerge take very different approaches to video editing.

MEDIAMERGE

MediaMerge targets the business user by providing simple video-editing functions and a nearly self-explanatory interface. Three modules—the Storyboard Editor, the Scene Editor, and the Audio Editor—take the divide-and-conquer approach to moviemaking. Sequencing is the job of Story board Editor, compositing is done in the Scene Editor, and creating sound files is done in the Audio Editor.

Business users will love the Storyboard Editor because it looks—and works—a lot like the slide sorters common to presen-

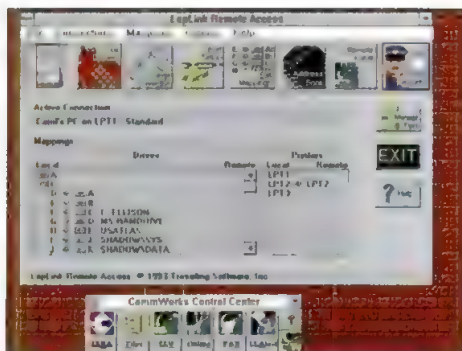
Continues on page 38

■ A Communications Deal That's Hard to Resist

CommWorks: Bargain Bundle Includes LapLink, Remote Access Tools

BY CAROL ELLISON

CommWorks, the new collection of Windows-based communications utilities from Traveling Software, does for business travel what the powerhouse application suites from companies like Lotus and Microsoft are doing for office productivity. With send-and-receive fax capability; remote access to distant PCs, networks, and peripherals; on-line services and bulletin boards; and security and notification features, CommWorks is the road warrior's Swiss Army cleaver.



FAR, YET NEAR: LapLink Remote Access lets remote users see mapped drives and ports.

Affordably priced at \$199, CommWorks bundles Traveling Software's popular file-transfer utility, LapLink V (First Looks,

May 11, 1993) with TS Fax, LapLink Remote Access for remote node connections, LapLink Alert for notification and security alerts, and TS Online, a terminal emulator. LapLink V operates as a DOS application running within Windows. All other utilities are completely Windows-based.

An automatic install program removes most of the mysteries of PC communications. You simply identify your modem or a compatible one from a list of 75 supported

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First Looks

Multimedia

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tation graphics programs. Each "slide" represents a video clip. Adding transitions between clips is as simple as choosing one of nine basic effects (like Venetian Blinds or Clock Wipe) from a dialog box.

The Scene Editor does a wonderful job of making video overlay techniques immediately understandable. It does this by showing you a real-time composite of all 16 available video-editing tracks. This feedback is especially important when you use one of the three key (or transparency) options offered by MediaMerge: Chroma, Luma, or Color Zero. If you use one of the key options to make the background of a clip in a track transparent, the results are immediately shown in the composite window.

By stressing ease of use, MediaMerge necessarily constrains certain functions. This sort of common-sense compromise is epitomized by the Text Animator tool. If you want a long list of credits or fancy text effects, you'll be disappointed by the 256-character limit, lack of support for Type1 fonts (only TrueType is currently supported), and the inability to position text interactively on screen. But you'll be thrilled by the Text Animation dialog box, where preformatted options for position and direction create perfectly scrolling text on the first or second try.

MediaMerge's Audio Editor is a separate utility that lets you create a true soundtrack for your movies. In addition to cut-and-paste functions, you can apply any combination of 14 filters. Workhorse filters, such as Gain and Fade In/Out, let you adjust the volume of a .WAV file, and special-effects filters, such as Reverb and Mix Loop, give you the power to create wholly new sounds.

During our testing, MediaMerge proved to be an extreme-

ly stable product with only a very few—and fairly minor—bugs. For example, the Scene Editor could not properly import an LZW compressed TIFF file but had no trouble with uncompressed TIFF. We were less than impressed with the preview functions, which use the Microsoft RLE8 compression format and are often posterized. In addition, MediaMerge always caches to disk, which means that performance for previewing and producing movies—even on our 66-MHz 486 test system—was slow.

•List price: *MediaMerge*, \$299. Requires: 4MB RAM (8MB recommended), 80MB hard disk space (160MB recommended), Windows 3.1. ATI Technologies Inc., 33 Commerce Valley Dr. East, Thornhill, Ontario, Canada L3T 7N6; 905-882-2600; fax, 905-882-2620.

Circle 432 on reader service card

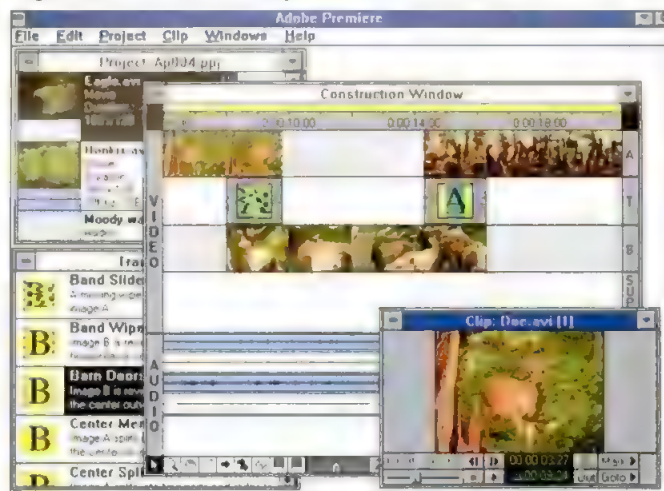
ADOBE PREMIERE

Adobe Premiere takes an integrated approach to video editing with a single Construction window where you can both sequence and composite video clips, audio files, and still pic-

that catalogs all of the various elements in a project.

The most serious drawback of Premiere's Construction window is immediately apparent: There are only four video tracks and three audio tracks. To be more precise, there are only two video tracks because one track is reserved for transitions and another is reserved for superimpositions. Ultimately, this is more of an inconvenience than a real limitation, because you can still create complex multi-image overlays by creating a movie and then reimporting it into a new construction window, where you overlay a third video clip.

In most other ways, however, Adobe Premiere offers truly sophisticated functions geared for large-scale, high-quality video production. For example, Premiere adds dynamite transition effects—such as zooms, trails, and spins—to the standard wipes and pushes for a total of 35 different effects. Incorporating a transition into your movie is as simple as dragging the animated icon (which shows you a schematic of the effect) from the Transition window to the Construction window.



PREMIERE: The construction window shows several tracks.

tures. All of the other windows in Premiere, which include the Transition, Clip, Info, and Project windows, perform managerial, previewing, or support functions. For example, the Project window is basically a database

Premiere's emphasis on power is evident everywhere. It can even access Adobe Photoshop's Plug-in filters directly in order to alter the visual content of a video clip. This means that you can improve the quality of a

video with filters such as Brightness and Contrast or Color Balance. You can also create special effects with filters such as Gaussian Blur, Emboss, or Spherize.

Premiere doesn't supply a composite view of the current video in the Construction window. It makes up for this minor shortcoming with speedy previews, made possible by its ability to cache to RAM. In fact, you can preview a movie, either whole or in part, by simply dragging your cursor along the time ruler—a function known to video editors as scrubbing. In fact, Premiere was consistently faster than MediaMerge when both previewing and producing a movie.

On a subtle level, it's possible to position both MediaMerge and Premiere in relation to other products from ATI and Adobe. The strong audio-editing functions in MediaMerge complement ATI's Stereo F/X-CD sound card. And there can be no doubt that Premiere builds upon Photoshop's image-editing expertise. But on the broadest level, MediaMerge is intended for casual or business users, while Adobe Premiere focuses on the needs of professionals.

MORE TO COME

The technology behind video-editing products is changing fast. Soon you'll see updates to both Premiere and MediaMerge. At the moment, Premiere is ahead of the game with support of Intel Indeo R3.0 and AVI Jpeg (MediaMerge ships with Indeo R2.1). In fact, Adobe has already promised a free upgrade at the end of the year that will add video-capture capabilities.

•List price: *Adobe Premiere, Version 1.0*, \$295. Requires: 8MB RAM (16MB recommended), 100MB hard disk space, DOS 5.0 or later, Windows 3.1, 256-color VGA graphics adapter. Adobe Systems Inc., 1585 Charleston Rd., Mountain View, CA 94039; 800-833-6687, 415-961-4400; fax, 415-961-3769.

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CommWorks

CONTINUED FROM PAGE 37

modems, as well as the serial or parallel ports you'll use for CommWorks' communications. The five utilities and the Control Center button bar that launches them may be installed individually or all at once. (Likewise, a smart Uninstall removes as many of the programs as you choose and restores system files to their original condition.)

REMOTE ACCESS/ LAPLINK ALERT

Users running Windows in 386-Enhanced mode load a small 7K TSR to enable a remote session. DOS applications and standard-mode Windows operation require three TSRs, which consume a total of 98K.

LapLink Remote Access (LLRA) doesn't offer a split-screen view of each PC's files and directories as LapLink V does. It maps drives and printers on the remote computer as if they were part of the connecting PC's drive configuration. If you work from a notebook PC with a floppy disk drive and a hard disk as the A: and C: drives, for instance, you'll see a remote desktop computer's two floppy disk drives and hard disk as the D:, E:, and F: drives.

Since access is bidirectional, LLRA must be enabled on both PCs before a remote session can begin. Once a remote access connection is established, the Control Center button bar can be expanded to reveal the remote drives and ports that are in use. Unlike Laplink V, however, LLRA does not support node access directly across a network. LLRA connections are made via modem, serial or parallel cables, or infrared links.

LLRA works in the background, allowing users at each end of the connection to contin-

ue their work more or less uninterrupted. Transferring large files slowed activity on our keyboard, although not too noticeably. LLRA is ideal for sharing and transferring files but, like all remote node access programs, it's not practical to run applications via a low-speed cable or modem connection.

TS FAX

TS Fax competes well with the popular WinFax Pro, losing to

as a group to be sent as consecutive pages in a single fax. And you can broadcast the fax to entire distribution lists.

TS Fax includes detailed send and receive logs. You can schedule fax transmissions and have the program automatically resend faxes if a connection is lost. A viewer lets you preview documents and coversheets as thumbnail images that can be zoomed, rotated, marked, or edited. A quick-memo text

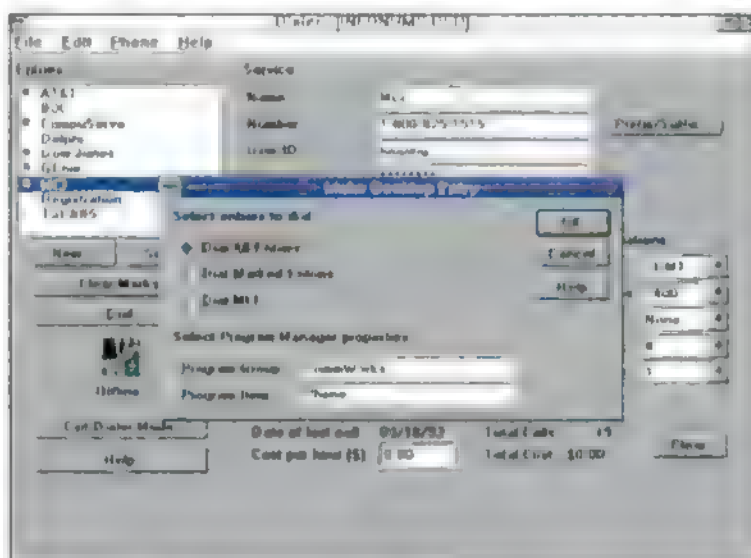
processor lets you fax short messages directly from the program. Longer documents and spreadsheets are faxed directly from applications.

TS ONLINE

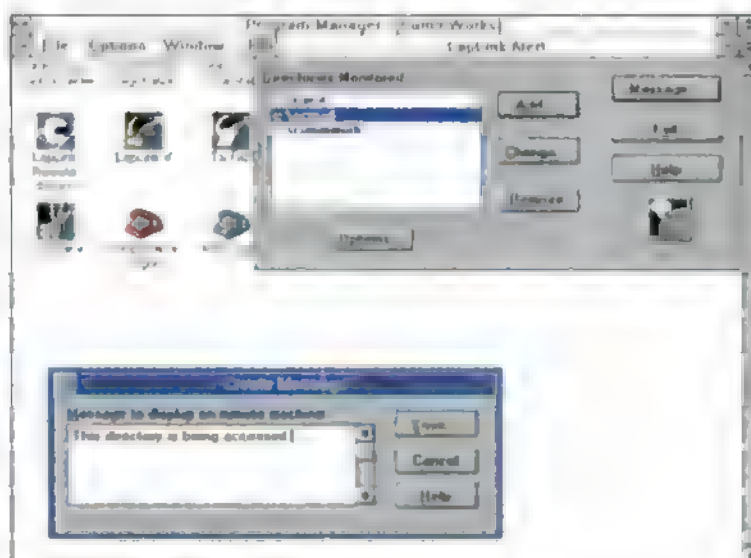
TS Online is a utility for connecting to on-line services, bulletin boards, and other computers via a friendly, menued Dialer Mode. Dialer offers tools to automate on-line activities in scripts and comes with a script language of more than 200 commands. During installation, CommWorks prompts you to enter your CompuServe and MCI Mail IDs and passwords and builds separate desktop icons in the CommWorks program group to launch log-on scripts for each service.

The Dialer Mode records names and local numbers of favorite bulletin boards and the log-on IDs and passwords that go with them, as well as protocol and terminal emulation information, and even a cost-per-hour charge for every number dialed. CommWorks tracks time spent on-line with each number and estimates the running cost of the connection.

TS Online supports ANSI Color, DEC VT-52, VT-100, VT-220 and



ACCESS ON: TS Online will sequentially dial computers in a group.



COMM SENTRY: LapLink Alert lets you create custom messages that pop up.

that competitor on the number of cover pages but beating it with the ability to automatically forward incoming faxes to another location. This forwarding feature makes it ideal for people who often work in remote offices and need a way of retrieving important incoming faxes while they're away.

If the program's half-dozen boilerplate cover sheets don't suffice, you can create and customize your own by importing or scanning in letterhead, signatures, and graphics files. Multiple graphics files can be tagged

**CommWorks
for Windows,
Version 1.0**

*Traveling Software Inc., 18702
North Creek Pkwy., Bothell,
WA 98011; 800-343-8080, 206-
483-8088; fax, 206-485-6786*

List price: \$199.95; \$69.95 for registered LapLink owners.

Requires: DOS: 465K RAM (520K recommended), DOS 3.1 or later, Windows 2MB RAM, 6.5MB hard disk space, Windows 3.1

In short: A bargain all-in-one communications utility package that should meet the fax, on-line, and remote computing needs of most users

ON READER SERVICE CARD

TTY terminal emulations, as well as popular transfer protocols including Kermit, X-Modem, YModem, ZModem, and CompuServe B, as well as data-transfer speeds up to 115,200 bps. File transfers can take place in the background so you can continue with other work as files are being sent.

The Dialer Mode reverts to Terminal Mode when a connection is made. Terminal Mode provides a text editor as well as a viewer for viewing .GIF and .RLE files. The Terminal Mode also captures 25 to 399 lines of the session to a memory buffer.

From there, text can be copied to the Windows clipboard and pasted into other applications, or pasted back into Terminal's text editor and sent back to the other computer.

Features like fax forwarding, password security built into address book entries so that intruders are disconnected before being prompted for an ID, and the ease of drag-and-drop file and directory transfers across remote nodes make this a standout companion for any traveling executive. □



From November 8 through November 12, you can go on-line to download a demo of CommWorks or to discuss the program with Carol Ellison and Traveling Software CEO Mark Eppley. Type GO ZNT:EXEC from any CompuServe prompt.

■ Ink Jet Printers

HP's DeskJet 310 Is Colorful, Portable

BY GREG PASTRICK

Hewlett-Packard's DeskJet printers enjoy a reputation for producing excellent low-cost thermal ink jet output. While not necessarily known for exceptional speed, the rugged DeskJets have earned most-favored-peripheral status for their small footprints, durability, and easy upkeep.

The \$379 DeskJet 310 continues the tradition while marrying two capabilities that came late to the line—color and portability—in a smartly designed 4.3-pound printer with a 2-page-per-minute rating, 300-dpi resolution, and PCL-3 compatibility.

Broadening its portable printing base, HP also sells a Macintosh PowerBook-compatible version, the DeskWriter 310, for the same price.

A number of affordable accessories support the DeskJet 310. There are black and color cartridges, a carrying case, a cartridge holder, a cut-sheet feeder, a parallel cable, a rechargeable battery, and a recharger.

VERSATILE DESIGN

The 310's versatile design gives you many different ways to use the 2.5- by 12.2- by 5.8-inch (HWD) printer. It accommodates standard DeskJet black and color plug-in ink jet boxes (\$21.95 and \$34.95, respectively). Since color is considered an option with the 310, you can stock it with only black cartridges, available on the street for about \$19, and forget about the color altogether if all you print is text.

As it turns out, the color capabilities are less flexible than

you might imagine, since you can't effectively print text while the 310 is in color mode. To switch modes, you have to switch cartridges. While it's easy enough to do (the 310 gives you direct access to the cartridge cradle), it's certainly not as efficient



CARRY COLOR: The 310 weighs 4.3 pounds.

as an all-in-one color cartridge would be.

To solve the problem of having an opened ink jet cartridge hanging around while you're printing, HP supplies a cartridge holder in its \$49 Color Kit. It looks something like an oversized Zippo lighter with two guides to keep the printheads from contaminating each other.

The 310's \$99 fold-in cut-sheet feeder is as compact as the printer itself, with a base measurement of 12.2 by 9.3 inches, and it holds up to 60 pages. To set up the sheet feeder, you simply dock and lock the 310 into it, set the printer and input tray to its standing V printing position, and turn the DeskJet on. The ability to push paper without jams is always the

best measure of sheet-feeder performance, and the 310 handled the standard stock we fed it without problems.

Using the DeskJet without the sheet feeder is a manual task, and HP includes two portable braces that hold the 310 in an angled upright position for easy paper input and output.

BATTERY POWERED

HP's \$49 nickel cadmium battery is rated for up to 100 pages of printing, but you can always use its 10.5-ounce AC adapter.

To help conserve power, the DeskJet has automatic sleep and power-down modes that are activated when you use battery power. Running on batteries has a price, though. Letter-quality speeds remain the same—about 167 characters per second—but draft print speeds are cut in half.

In testing, the DeskJet 310 met its claimed 2-ppm rating, running our text and graphics speed tests at 2.1 ppm and 2 gppm, respectively. Using its tricolor cartridge, the 310 produces presentable color output, though the tricolor blacks tend to have a green cast to them. Text printing with the black cartridges doesn't produce



Our wretched species is so walk on the well-trodden path at those who are showing a Normal Bold Italic compress

OUTPUT SAMPLES: Text printing is fine for business and the color output is surprisingly good.

FACT FILE

HP DeskJet 310

Hewlett-Packard Co., Direct Marketing Organization, P.O. Box 58059, MS511L-SJ, Santa Clara, CA 95051; 800-752-0900, 208-323-2551; fax, 208-344-4809

List price: \$379; with cut-sheet feeder, \$455. Color Kit, \$49, cut-sheet feeder, \$99; rechargeable battery, \$49; universal rapid recharger, \$99; carrying case, \$99; Centronics parallel cable, \$19; black print cartridge, \$21.95; tricolor print cartridge, \$34.95.

In short: The 4.3-pound DeskJet 310 lets you print color on the road. Its only drawback is that you have to switch between black and color cartridges by hand.

ON READER SERVICE CARD

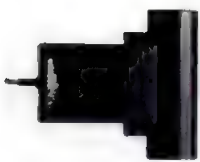
characters as crisp and clean as laser output, but the 300-dpi resolution certainly looks professional enough for most work.

You can change the printer's settings either manually or through the supplied DeskJet menu software included on the installation disk. To set the printer up manually you have to open it, then advance and align the print cartridge cradle with the printer setting options printed on a strip inside the printer.

HP's DJPMenu software offers a far easier setup and adds some extended settings such as sleep mode, power-off timings, and graphics resolution selections.

Standard features on the DeskJet include a 48K buffer, a Centronics parallel interface, and four built-in fonts: Courier, CG Times, Letter Gothic, and Univers. Macintosh PowerBook users get the same basic printer, plus a serial and AppleTalk interface along with a Quick-Draw driver. □

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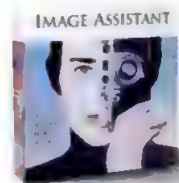


With OmniScan, you can send, receive, OCR, and compress faxes right from your computer using Caere's FaxMaster technology. All you need is a fax modem. OmniScan does the rest.



Scan directly into any application with OmniPage Direct. Direct employs Caere's AnyPage technology to provide the most accurate OCR possible. Font sizes, styles, and formats are no problem for OmniScan Direct's OCR.

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CIRCLE 292 ON READER SERVICE CARD

For Your Information.

■ Page Printers

Lexmark's New Page Printer Hits \$799 Price Point...

BY BRUCE BROWN

Lexmark's IBM 4037 5E page printer has a high duty cycle, flexible paper handling, and ergonomic design features—all for a low \$799. You can't print quickly with this 5-page-per-minute (ppm) printer, but you can print for a while. It has a 16,000-page monthly duty cycle.

The 4037 uses an 300-dpi LED engine rather than a laser engine to create its images. Lexmark's PQET enhancement technology increases the effective resolution to 1,500 by 300 dpi, which in testing was a bigger help to text than to graphics.

Equipped with a standard parallel port and 512K RAM, you can upgrade the 4037 with a

serial interface and with both conventional and flash RAM. You can increase conventional RAM to 4.5MB. The optional flash RAM (available in either 256K or 1MB sizes) can be used



CONTROL: ATM-like function menu.

to download fonts to the printer permanently for convenient and fast access.

There are 10 bitmapped and 16 scalable fonts for use in Pro-

Printer mode and 14 PCL 4 bit-mapped fonts in HP mode. The 4037 tested at 4.8 ppm in text mode and 1.5 gppm in graphics mode speed testing.

The standard 150-sheet letter-size paper tray can be augmented by a 250-sheet second-page feeder that attaches to the bottom of the printer. A fold-down manual feed tray also feeds envelopes.

You won't find a printer that's easier to use. From its one-piece, drop-in 3,500-sheet toner cartridge to its ATM-like four-line function menu to its change page, paper, mode, and font settings, the 4037 shows what happens when designers put a heavy emphasis on ergonomics.

The IBM 4037 isn't a great choice for high-speed or graphics-intensive printing needs, but it's hard to beat as an extremely easy-to-use, low-cost, rugged unit for standard text printing.

• List price: IBM 4037 5E, with 512K RAM, \$799; toner cartridge, \$114; 250-sheet paper feeder, \$189; 150-sheet letter tray,



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walk on the well-tr
at those who are sh
Normal Bold Italic

OUTPUT: The text's look is enhanced by high resolution.

\$49; 250-sheet letter tray, \$59; 23-font card, \$99; serial adapter, \$119. Lexmark International Inc., 740 New Circle Road NW, Lexington, KY 40511; 800-358-5835, 606-232-2000; fax, 606-232-2380.

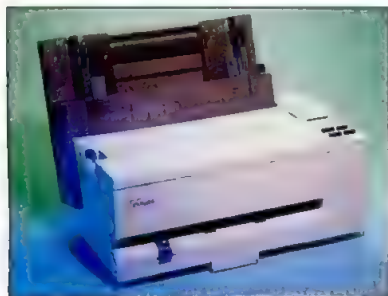
Circle 424 on reader service card

■ Ink Jet Printers

...And the ExecJet II Delivers Laserlike Quality for \$399

BY BRUCE BROWN

Lexmark's IBM ExecJet II delivers on ink jet printing technology's promise: laser-printer-quality output at a price competitive with that of most 24-pin dot matrix printers. With its \$349 list price, the ExecJet is a reasonable first printer or a great upgrade for users looking to replace dot matrix printers.



45 dB: The ExecJet runs quietly.

The 300- by 300-dpi ink jet uses Lexmark's PQET resolution enhancement to achieve an effective 600-by-300 resolution. Rated at 3 pages per minute, the ExecJet attained 2.4 ppm on PC Labs' Text Print Speed test and 1.9 gppm in graphics mode testing.

Power-down technology has earned the ExecJet an Energy Star—compliant rating. Printing is whisper-quiet (rated at only 45 dB); when the ExecJet is not printing, it makes no noise at all. A 2,000-page monthly duty cycle, however, relegates it to low or moderate use.

The ExecJet comes with a 21K print buffer that can be upgraded with 256K of conventional RAM to store down-



Our wretched spe
walk on the well
at those who are
Normal Bold Ital

OUTPUT: Effective 600- by 300-dot-per-inch resolution.

loaded fonts; it can also accept 256K or 1MB flash RAM options to store fonts permanently.

A 56-nozzle replaceable print cartridge is rated to last for 1,000 sheets with 5 percent coverage; replacements cost \$31.95.

Replacing the print cartridge is simple. An Install Print Cartridge button on the operator control panel centers the cartridge holder to make it easy to extract the old cartridge and insert a new one.

Paper feeding is another strong point. A top-mounted 150-sheet feeder is simple to load and can handle paper, transparencies, and envelopes. You can also feed heavy or wide (up to 9 inches) stock via a front manual feed slot.

If you want laser-like output quality at a dot matrix price, the ExecJet is a fine choice as long as you don't need high-volume printing.

• List price: IBM ExecJet II, \$349; replacement print cartridge, \$31.95; 256K flash memory, \$99; 1MB flash memory, \$199; serial interface adapter, \$119. Lexmark International Inc., 740 New Circle Road NW, Lexington, KY 40511; 800-358-5835, 606-232-2000.

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PC Magazine Editors' Choice for Database Development



DBMS Readers' Choice winner for client-server development system

Feature	CA-Clipper	FoxPro	dBASE IV
Lexical variable naming	YES	NO	NO
User-defined commands	YES	NO	NO
Code blocks	YES	NO	NO
Nested Macro/Menu/Array	YES	NO	NO
Predefined object names	YES	NO	NO
Variable-Macro/Menu/Debugger	YES	NO	NO
Command-line/Menu/Editor/Debugger	YES	NO	NO
Reads and Writes FoxPro (.CDX) Files	YES	YES	NO
Reads and Writes dBASE IV (.MDX) Files	YES	NO	YES
Reads and Writes Paradox (.P) Files	YES	NO	NO

Comparison based on FoxPro Version 2.5 for DOS and dBASE IV Version 1.5

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New CA-Clipper 5.2.

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■ Scanners

ScanMan EasyTouch: Gray-Scale Scanning for the Patient and Steady

BY STAN MIASTKOWSKI

Logitech's ScanMan EasyTouch goes a long way toward eliminating the negative reputation of handheld scanners. This 256-shade gray-scale scanner hooks up to your PC's parallel port, sets up in minutes, and comes with both image-editing software and an optical character-recognition (OCR) package.

Although it automatically stitches 4.5-inch-wide swatches into images up to 8 by 15 inches, it's still nowhere near as convenient as a flatbed scanner. But for \$399, EasyTouch is fine for users on a budget.

The radical design of EasyTouch is immediately noticeable. The half-moon arrangement looks awkward at first, but the wisdom of its ergonomic design is evident the first time you grab it. Instead of the twisted-wrist posture needed for other hand scanners, the EasyTouch lets you extend your hand straight out. Also notable is the lack of the usual assortment of switches and sliders. There's just a solitary button and an LED. Resolution and contrast are controlled through software.

PARALLEL CONNECTION

The EasyTouch's parallel port connection eliminates the hassle of opening up your PC and dealing with an add-in card. It's also perfect for use with a laptop, if you don't mind the tangle of hardware and wires. The pass-through connector that you connect to your PC's parallel port is sizable. With the printer cable attached, it extends nearly 7 inches from the back of your PC. The connector is designed to let

FACT FILE

ScanMan EasyTouch
Logitech Inc., 6505 Kaiser Dr.,
Fremont, CA 94555; 800-231-
7717, 510-795-8500; fax, 510-
792-8901

List price: \$399
Requires: 4MB RAM, 5MB hard disk
space, Microsoft Windows 3.1, parallel
port
In short: A next-generation parallel port
gray-scale scanner that's easy to set up
and use. Twain compliant, it automati-
cally interfaces with major Windows
applications and comes with image-
editing and OCR software. Not designed
for heavy production or tight deadline
use, it's relatively slow and requires a
steady hand


ON READER SERVICE CARD

you use both the scanner and a printer through the parallel port, although obviously not at the same time.

The installation software tests to make sure the scanner works and then installs the two applications that make the EasyTouch truly useful. FotoTouch 1.2 is a feature-filled image-editing package that also handles color for work with images other than the gray scales generated by EasyTouch. And there's OmniPage Direct AnyFont OCR, customized by Caere Corp. for use with the EasyTouch.

Logitech has left out only one important thing: an uninstall option. Since the EasyTouch install creates

multiple directories, copies files into your \WINDOWS directory, and edits both your WIN.INI and SYSTEM.INI files, the lack of a way to uninstall it if you move the scanner to another PC is a major oversight.

TWAIN COMPLIANT

The EasyTouch is compatible with any Twain-compliant application (Microsoft Word, Aldus PageMaker, CorelDRAW, and Lotus Freelance, for example), so once it's installed, an "Acquire" option appears on the application's File menu. The scanner's working menu then pops up, and it's a simple matter to follow the directions on the screen. When you want to scan in text for OCR, OmniPage adds an "Acquire Text" option to your application.

We found that getting the most from EasyTouch requires practice and patience, not to mention a steady hand. Don't try scanning after your fifth mug of morning coffee. A large, flat, and not-too-slippery area for the

image you're scanning is also crucial; if the photo or paper moves, you'll have to start again.

Compared with a directly connected scanner, EasyTouch's parallel interface limits the throughput. You need to move the scanner at just above a snail-like pace, helped along by the scanner's LED, which turns from green to yellow if you start to move too quickly, and to red when you're scanning too fast. You'll also need some processing power for the automatic stitching and image processing. Depending on the size and the complexity of the image, the process can take a couple of minutes on a 386SX-based system versus just a few seconds on a 66-MHz 486.

The AutoStitch abilities are just short of amazing: It figures out where multiple scans fit together even if you've managed to skew one of the scans. It's a bit fussy about the overlap, but you can do manual stitching.

To get the most from EasyTouch, you'll need to do some tweaking with the contrast and resolution settings. For example, 100 dpi works best for scanned photographs with a garden-variety 300 dpi printer, and the 300 dpi setting is essential for OCR. If you want to clean up or change images, FotoTouch offers a full toolkit of image manipulation and drawing tools. And OmniPage is a shining example of current OCR technology.

The EasyTouch is great for scanning in a quick image or converting a short document to data. But it still won't replace a flatbed scanner for serious production work. And, of course, it doesn't do color. We also found it far from ideal for scanning in documents for faxing (it was quicker to walk over to the fax machine). Still, for occasional scanning chores, EasyTouch delivers quality images to your PC with a minimum of hassle. □



UNCOMPLICATED: Logitech's sleek design.



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This \$20 billion airport construction project also includes the construction of highways, an airport rail system, a suspension bridge and a cable stay bridge. Projected completion is June 1997.

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This \$100 million, 420-meter tower will be the third tallest communication tower in the world. Estimated completion date is 1996.

The Georgia Dome, USA

The new \$210 million structure features the world's largest cable-supported dome. P3 and Expedition® were used for scheduling and control.

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■ Accounting

QuickBooks: Easy Accounting Has a Few Trade-offs

BY GREGG KEIZER

It costs money to count money. But cutting accountants' fees by keeping your own books is a sticky proposition, particularly for small-business owners who don't have time to learn traditional accounting practices.

That's when Intuit's \$159.95 QuickBooks for Windows' quick-start, form-based, relatively jargon-free approach makes sense. Even the most ledger-phobic users will be writing a check or invoice within minutes. That ease of use comes at a price, though, for unlike other Windows accounting packages, this program doesn't include payroll, inventory control, order entry, or customizable invoice building.

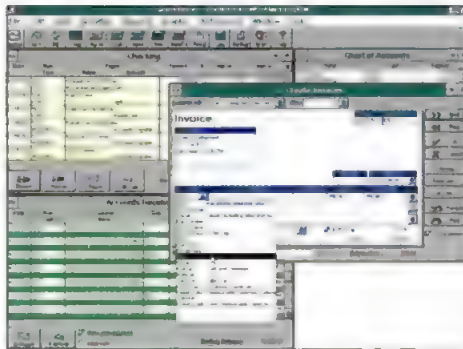
QUICK START

QuickBooks for Windows shows its roots—Quicken for Windows and QuickBooks DOS—right from the start. Installation and setup are a snap; an animated tutorial demonstrates the program; and its QCards teach you the finer points as you work. If you're starting from scratch, QuickBooks lets you select from 20 predefined charts of accounts that set up your books for such fields as medicine, real estate, and construction. And if you're moving from the DOS version of QuickBooks, your data transfers across.

Unlike its DOS forerunner, QuickBooks for Windows relies almost exclusively on forms rather than line registers for completing transactions. You write checks in a check window, create invoices in an invoice window, note bills in a bills window. You can keep multiple windows open simultaneously, accessing

all forms from a menu or the most important from the icon bar. That icon bar can't be modified, an irritating omission considering that QuickBooks for Windows 2.0 allows for bar additions.

Navigating through and filling out these forms is simplified by the program's shortcuts, drop-down lists, and its ability to memorize transactions and invoices for later recall. QuickBooks for Windows even retains many of the keyboard com-



BILL ME: Invoices are simple.

mands familiar to its DOS users.

QuickBooks for Windows uses the checkbook as its foundation, then adds accounts receivable, invoicing, and accounts payable. Except for their formlike look, they work similarly to their counterparts in QuickBooks DOS, although here the accounts payable system is much easier to handle.

Accounts receivable and invoicing offer several new features, including one-click sales tax calculation, fast assigning of reimbursable expenses, and the ability to summarize items on the printed invoice. You're still restricted to using one of three invoices styles—product, service, and profes-

sional—and although you can add miniature logos (from .BMP images) and align text, you cannot design or even moderately modify an invoice form.

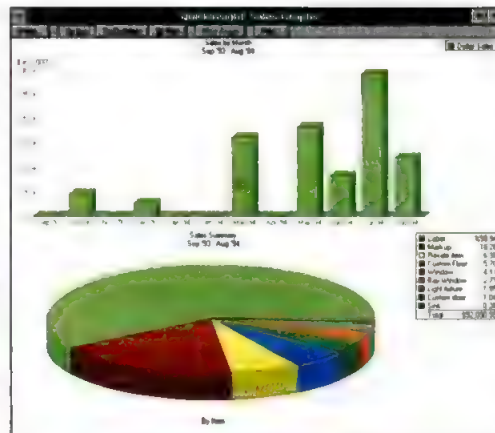
Reporting is both slicker and more extensive in the Windows version. Fifty-two ready-to-use reports are available, and all can be customized by criteria such as date range, account, and customer. A QuickReport feature pulls up the predefined report associated with almost any item or transaction at the click of the mouse. Select a check from the register, for instance, and the QuickReport shows all checks written to that payee.

Six graphs graphically illustrate such things as sales, accounts payable, and net worth, and you can quickly zoom on nearly any element for a look at its supporting data or report.

Other useful features include the ability to tag income and expenses to individual jobs, not just customers, and even build budgets for each job. A new credit memo/refund window simplifies these tasks, a cash sales window handles on-the-spot receipts, and two levels of security shield registers and balances from unauthorized eyes.

WHAT'S MISSING

QuickBooks for Windows lacks several elements crucial to complete accounting. Though you



DETAILS: Zoom in for more detailed information.

FACT FILE

QuickBooks for Windows, Version 2.0

Intuit Inc., P.O. Box 3014, Menlo Park, CA 94026; 800-624-8742, 415-322-0573

List price: \$159.95; QuickBooks/QuickPay bundle, \$199.95 (\$45 rebate for QuickBooks owners, \$25 rebate for Quicken owners through April, 1994).

Requires: 2MB RAM (4MB recommended), 8MB hard disk space, Microsoft Windows 3.1 or later.

In short: QuickBooks for Windows is a fast-starting, form-based, jargon-free accounting package for small-business users. Its ease of use comes at a price, however, for it lacks integrated payroll and omits such modules as inventory management.

ON READER SERVICE CARD

can add the QuickPay companion program, QuickBooks cannot do such commonplace payroll chores as calculating deductions and withholding on its own. But the program also lacks dedicated inventory or order entry modules, and it won't automatically figure finance charges on late invoices. If you demand any of these functions, particularly inventory control, order tracking, or fast finance charge generation, don't bother with QuickBooks.

If you're using QuickBooks DOS but work in Windows, switch to this graphical version. Although there's no single compelling reason to make the move—the enhanced reporting comes closest—the combination of new features and Windows' conveniences are enough to justify the upgrade. If you haven't tried electronic accounting, QuickBooks for Windows provides an almost instant entry, especially to businesses selling services, not widgets. Either way, it's the next best thing to firing your accountant. □

■ Mapping

Sure!Maps: Market Research in a Box

BY LANCE ULANOFF

Horizon Technology wants you to throw out your wall map and pushpins. Its \$199 Sure!Maps 2.0 reinvents the marriage of maps and market data analysis, and adeptly—albeit slowly—tosses it all onto a PC screen.

Sure!Maps is a powerful—though sometimes confusingly esoteric—geographic market

Maps does have a tool/status bar at the base of the screen with features that can be accessed using the right mouse button.

You load maps through a Load Map dialog box, using the city, the state, the ZIP code, or even the street address to select the desired topography. A scroll list of cities is also included on the screen, with X's next to the those areas supported in your selected scale (scales range from that of a satellite "spot shot" down to 1 inch = 8,000 feet). Unfortunately, instead of paring the list down by removing locations not supported in a given scale, all the cities remain; thus, you have to scroll through them all, looking for the ones with an X next to them.

The standard product ships with maps of the Dallas area (you order your own for approximately \$99 per map set), and a sample real estate template that includes various kinds of residential properties and boilerplate data that's attached to the Dallas street map. The product also accepts imported dBASE data, and the datasets can be linked to a .DBF file (although updates from a changed data-

base must be performed manually).

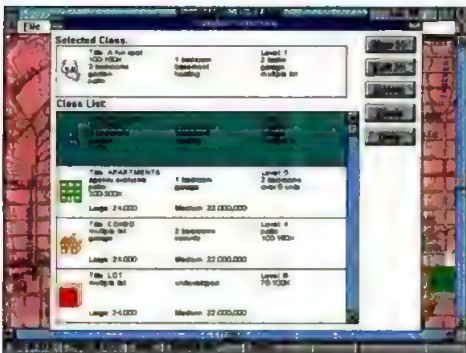
Sure!Maps features strong data manipulation and search abilities and includes a fuzzy search engine with its Filter Editor. This allows you to select the degree to which a symbol class must match the filter criteria (a value of 100 would indicate a 100 percent match). Also, reports and/or maps can be output on paper or to export files for placement in presentations.

Although Sure!Maps ran on a

25-MHz 386-based system with 8MB RAM and a 1MB VGA card, it obviously craved more power, as the screen slowly regenerated the map image after we brought up dialog boxes. Tucked in the back of Sure!Maps' rather confusing manual is the admission that the product would do much better either with a math coprocessor or on a 486 machine.

• List price: *Sure!Maps 2.0*, \$199. Requires: 4MB RAM, 2MB hard disk space, Windows 3.1, CD-ROM drive. Horizons Technology Inc., 3990 Ruffin Rd., San Diego, CA 92123; 800-828-3808, 619-292-8331; fax, 619-292-7321.

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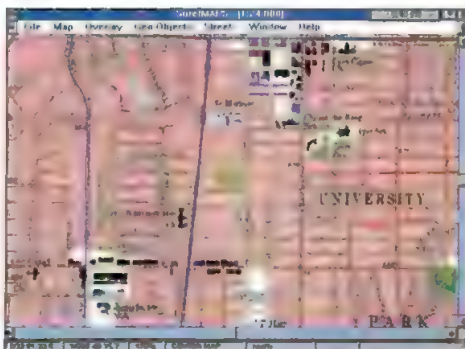


ICON SEE THAT: Libraries of symbols and information can be built in Sure!Maps.

analysis tool. It links market data with images by combining rasterized USGS topographic maps (of various scales and degrees of detail) and ETAK digital, street-level map overlays (both read off CD-ROM), with libraries of icons, or symbols, and user-supplied data for map annotation (groups of icons and data are referred to as Symbol Classes).

You can create your own information databases from the ground up—including icons—or use the supplied data forms and images. The product also features a selection of free-form map annotation tools that include ellipses, lines, boxes and text.

The interface is relatively straightforward. Though it lacks a traditional toolbar, Sure!



OVERLAY LAND: Maps, icons and ETAK street maps can all be combined on screen.

■ Utilities

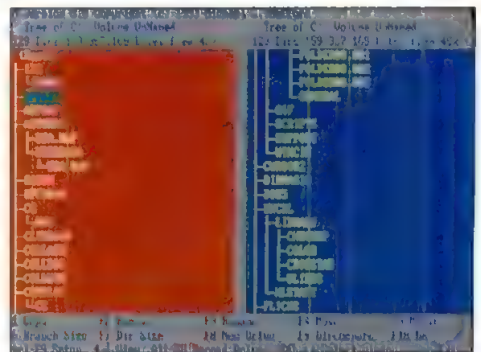
DirMagic: Quick and Easy DOS File Management

BY DON WILLMOTT

Countless *PC Magazine* readers are familiar with DR and RN, two of the most popular DOS file management utilities we've offered. Now their developer, MJM Software Design, has upgraded DirMagic, a combined version of the two programs, to Version 3.0 and is selling it for \$39.95.

To put it simply, DirMagic is quick file management for keyboard-centric DOS diehards. There are few bells and even fewer whistles.

The screen gives you two directory trees onto which



TWO TREES: DirMagic lets you move files between directories and drives.

you can log two different drives. Each function key handles a task: copy, remove, rename, move, make a directory. Version 3.0 adds directory comparison.

The F10 key takes you to DR, which sorts files by name, extension size, or date.

Drill down in the directory tree to the file level and you can view certain types of files (most-

ly text). New to this version are viewers for Microsoft Word, Q&A, WordPerfect, and WordStar. Also new is basic mouse support and some screen customization, including colors.

Any Windows-based file manager can do all that DirMagic does more colorfully and

more visually, but if you live in DOS, DirMagic is just about the quickest way to sort, view, copy, and move your files.

• List price: *DirMagic, Version 3.0*, \$39.95. Requires: DOS 3.1 or later. MJM Software Design, P.O. Box 129, Gleneden Beach, OR 97388. Fax orders, 503-764-3935.

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■ Voice Recognition

\$99 VoiceAssist Listens to You

BY GREGG KEIZER

We're still a long way from 2001: *A Space Odyssey's* "Open the pod bay doors, Hal," but voice recognition on the PC at least has the door ajar. Hands-off operation is possible with the right combination of hardware and software. One of the most usable kits is Creative Labs' \$99 VoiceAssist, a voice training and recognition package that works within Windows. It may not have the wide-ranging components of something like the more expensive Microsoft Windows Sound System, but it does succeed at its designated task: telling your PC what to do.

VoiceAssist, which also ships as part of Creative Labs' 16-bit series of Sound Blaster sound boards, comes with a too-large, unidirectional microphone that plugs into any supported sound card. Creative Labs neglected to include a stand for the mike, so you'll have to hold it like a lounge singer or lay it on the desktop. Neither solution is adequate. The company would be smart to copy the kind of elegant microphone that Microsoft provides with its Sound System.

Naturally, VoiceAssist works with Creative Labs' own Sound Blaster and Sound Blaster Pro, as well as the numerous compatible clones of that audio standard. It also handles the 16-bit board within the Windows Sound System. Installation of VoiceAssist itself is a

snap, for it assumes you've already gone through the setup nightmares often associated with audio hardware. In testing, the program performed well with both a Sound Blaster 16 and a Windows Sound System board without a glitch.

Setup is far from over even when you have the software on the hard disk, since you have to spend considerable time creating new voice commands, training those commands, and associating macrolike recordings with them before your PC responds to the spoken word.

VoiceAssist installs a short slate of 24 generic commands such as open, close, left, and right that work within all Windows applications. Go to sleep and Wake up commands are included to turn the microphone off and on.

VoiceAssist is also ready to run File Manager, Program Manager, and Windows' applets such as Cardfile and Calendar. You can't change or add to the generic commands—a serious flaw, considering the many commands shared by most Windows apps—but you can change the application names to better suit your software suite. Dropping the trivial Clock and substituting Word for Windows, for instance,

an application, you select a user, insure that VoiceAssist is active, and then launch the application. Like the Windows Sound System's Voice Pilot voice-recognition module, VoiceAssist automatically extracts the menu items from the application so that all you do is train the voice. That speeds up the process of adding voice recognition considerably.

CUSTOM COMMANDS

You can also build custom commands in a short three-step process of naming the command, training its voice, and assigning a macro. To add the command "New document" to Microsoft

Word for Windows, for example, you simply type in the name, say "New document" into the microphone, and then record the keystrokes necessary to call the File menu. Then you select New and hit Enter.

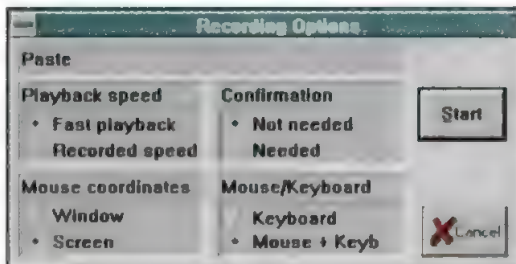
VoiceAssist is smart enough

to know what application is active and change its library of commands accordingly. And its 224-command-per-application limitation shouldn't restrict even the most vocal user. Once trained, even with just a single iteration during training, these commands work remarkably well. In fact, when compared with the hit-and-miss success of Voice Pilot 1.0, VoiceAssist was far more reliable. Voice Pilot had trouble distinguishing between "close" and "tools," and thought it heard "enter" when "character" was spoken. VoiceAssist knew the difference and acted appropriately. (Both had been rigorously trained in Word for Windows, and both were using the input microphone and sound board from the Windows Sound System.) A success rate of 90 percent or higher was common.

Nothing is foolproof, of course. Like all such programs, VoiceAssist is virtually unusable in a noisy office, where background sounds, music, and voices can be misinterpreted as commands, with potentially disastrous effects. And its documentation is scanty, with all-too-brief mentions of important features. But at less than \$100, with easy training and an outstanding recognition rate, VoiceAssist is a package to talk up. □



LISTEN UP: Training VoiceAssist to recognize your voice is straightforward.



FOLLOW ME: VoiceAssist records keystrokes and mouse movements.

takes but a moment. VoiceAssist lets you define multiple users, each with his or her own way of pronouncing commands; supports more than 29,000 commands per user; and makes 1,024 commands available at once.

To add commands specific to

FACT FILE

VoiceAssist

Creative Labs Inc., 1901
McCarthy Blvd., Milpitas, CA
95035; 800-998-5227,
408-428-6600

List price: \$99

Requires: 4MB RAM, 1MB hard disk space, Microsoft Windows 3.1, 8- or 16-bit sound board

In short: VoiceAssist, voice training and recognition software for Windows that adds and executes spoken commands, works with amazing accuracy. Its most prominent flaws are a second-rate microphone and an inability to modify or add to its Windows-wide generic command list

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AT THE LOWEST PRICES

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pentium
PROCESSOR



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You get all the bells and whistles in one great package with Gateway 2000's feature-and power-packed VESA local bus 486 systems. We've always made the biggest bang in the industry with these outstanding machines. You get the expandability you'll need to continually upgrade your system to tomorrow's technology. We're proud to toot our own horn about these local bus PCs. They're a rare combination of everything-you-need at a fantabulous price.

Hard Drives

Just like closet space, you can never have enough hard drive space. Our 4DX-33V, 4DX2-50V and 4DX2-66V systems have whopping 424MB hard drives. Our 32-bit local bus IDE with exclusive RIDE BIOS provides you with the industry's leading disk throughput.

Video Performance

Although everyone tries to catch us, they can never keep up. Our latest ATI Ultra XLR 2MB video card still sets the standard for VESA graphics. With its unique architecture, the XLR allows the card to interleave 2MB of DRAM and achieve true 24-bit color at 640 x 480 and 800 x 600 resolutions.

The Ultra XLR also comes with special drivers to accelerate tomorrow's video and multimedia applications.

Cache

Secondary caches unlock the full performance potential of your CPU. Gateway VESA systems come standard with 128KB cache, and the award-winning DX2-66V has 256KB cache.

Your Choice Of Software

Only Gateway gives you a choice of top-shelf application software. VESA local bus and PCI systems include options such as Microsoft® Word for Windows,™ MS Excel,™ Borland® Paradox® and Quattro® Pro for Windows. Then we add Central Point's Tools on Top™ utility software, based on the award-winning PC-Tools for Windows. Systems with a CD-ROM drive include Gateway's System CD containing

FOR THE FEWEST B U C K S

Microsoft's Multimedia Pack,™ the Gateway Mall and much more. All software is pre-installed on your system at no extra charge.

AnyKey® Keyboard

Don't settle for a rigid 101-keyboard when you can have the flexibility of Gateway's exclusive 124-key AnyKey keyboard with programmable macros and keyboard remapping capabilities.

CD-ROM Drive

All DX2 VESA systems come standard with a CD-ROM drive, giving you access to exciting new applications, databases and entertainment programs. All Gateway systems can be easily upgraded to include a CD-ROM.

Expandability

For those of you who still want to jazz up your PC ensemble, we're giving you all the instruments you need for expansion. You get four external drive bays for floppies, a CD-ROM drive, tape backup, and don't forget all the media of the future. Three internal drive bays allow you to easily add hard drive space. Two VESA slots assure upgradeability to tomorrow's totally cool graphics and disk controller technology; and five ISA slots are compatible with 16-bit technologies.

Gateway has always had a reputation for marching ahead of the crowd by giving you the *greatest* values. Our award-winning VESA systems are no exception!

Standard with VESA systems is our new Baby AT case measuring 16.9-inches wide, 6.6-inches high and 16.8-inches deep.



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GET THE BIGGEST VALUE

The tall and short of it is: Gateway 2000 elevates value to enormous levels on our integrated mini desktop systems...but still gives you pint-sized prices. We've gone to extremes to bring you all new mini desktop configurations with colossal features and performance in a new case. Whether you need a 486SX-25 processor, a 486DX2-66 processor, or anything in-between, Gateway has the system for you. And with prices lower than ever, you get a huge value without having to pay an arm and a leg.

Big Performance/Little Prices

Check out Gateway's new 4DX2-66 mini desktop — it's a small package that packs a big punch for under \$2,000! While other companies might slash their prices, you could get the short end of the stick when it comes to features. Gateway won't short-change you on anything. You get a 66MHz 486DX2 processor, 128KB cache, a 424MB hard drive, 4MB RAM and fast video performance. Our 4SX and 4DX models come standard with Microsoft Works™ for Windows; 4DX2 models come with an extended selection of application software. And all mini desktop models come standard with MS DOS® 6 and MS Windows™ 3.1. All application software comes pre-installed on the hard drive at no extra charge.

Local Bus Video

Our new integrated local bus video provides up to twice the video performance found in our previous mini desktop systems. In fact, Gateway's mini desktop video performance is similar to that found in many of our competition's high-end systems. With up to 1MB video DRAM, you get 1024 x 768 resolution and an array of colors. All this on our 14-inch CrystalScan non-interlaced, .28mm dot pitch color monitor.

Price/Performance

How can we give you all these features at such low prices? Gateway's engineers went out on a limb to design our mini desktops to include many subsystems incorporated on the motherboard. This means less cost to us, and a giant savings for you!





ON OUR SMALLEST DESKTOP SYSTEMS

Increased Expandability

You won't have any growing pains with Gateway's new integrated mini desktop cases. They're small, but you get more flexibility and expandability than ever before. These cases come with one internal and one external 3.5 inch drive bays, and two external 5.25 inch drive bays so you can add a tape backup, CD-ROM drive or another floppy drive. You also get five expansion slots: more than you'll find in most small footprint PCs. And all Gateway mini desktop systems are upgradeable to Pentium technology.

With the *coolest* features at miniature prices, our mini desktop systems give you an unbeatable value. Call your Gateway sales representative today for more information on these power-packed mini desktop systems.

You get greater expandability with our new mini desktop cases, measuring 16.9-inches wide, 4.4-inches high and 15.9-inches deep.

Get a Gateway...



8 0 0 - 8 4 6 - 2 0 6 3



GET THE HARDEST HITTING MULTIMEDIA

Although it looks difficult, you can easily put a multimedia spin on your Gateway PC by purchasing our specially priced multimedia kit. With it you can access the most powerful productivity packages, the most realistic games and the latest multimedia applications.

Multimedia Upgrade kit

Everything you need to add multimedia to your PC is included in this specially priced kit! You get:

Sound Blaster™ 16 Sound Card with Advanced Signal Processing.

Simply the best sound card available! This 16-bit PC audio card offers CD-quality sound. Yamaha® FM music synthesizer, MPU-401 MIDI interface, joystick connector, built-in CD-ROM interface, and more. The Advanced Signal Processing chip delivers 4:1 real-time hardware data compression while reducing CPU demands by up to 65%. Provides 100% compatibility with all Sound Blaster applications, plus DOS and Windows sound support. You also get two Labtec® speakers that attach to your PC monitor.

Double-Speed CD-ROM Drive.

Kit comes with a high-performance double-speed CD-ROM drive. When you're not using it to run computer programs, it can play your favorite music CD's. You also get our free system CD with Microsoft Multimedia Pack™ and more!

Kit Price: \$395 (with system purchase)

Altec Lansing Speakers ACS-300 with Subwoofer

Get superior stereo sound with these top-rated Altec Lansing Speakers. This system includes two magnetically shielded, powered two-way satellite speakers and a separately powered subwoofer which uses a unique multi-path acoustic chamber design. The digital signal processing (DSP) circuitry creates full rich sound, presence and ambiance. **\$219** (with system purchase)

Software

Check out our latest software titles too. This new wave of exciting applications will forever change the way you learn, work and play!

THAT IS EASIEST ON YOUR BUDGET

MECC Education Pack

MECC, one of the leaders in education software has bundled four of their most exciting programs including: The Oregon Trail; Money Works/Clocks; Story Book Weaver; and Super Munchers. **\$59** (with system purchase)

Just Grandma and Me™

Watch your child's eyes light up with one of the most popular interactive, animated stories for children on the market. Just Grandma and Me is a multimedia smorgasbord of sound effects, music and animations. **\$42** (with system purchase)

The TIME Almanac 1993

Experience tomorrow's technology with the TIME almanac. This package now offers a comprehensive collection of 15,000 TIME magazine articles and nearly 60 minutes of current and historical videos. **\$75** (with system purchase)

Microsoft Encarta Encyclopedia

Where typical encyclopedias end, Microsoft Encarta begins. Bringing learning to life with words, images, animations and sounds, Encarta includes the complete text of the 29-volume 1992 Funk and Wagnall's New Encyclopedia. **\$249** (with system purchase)

Call for details on other exciting software packages.



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GET THE STRONGEST SERVICE AND SUPPORT

We're committed to bending over backward to please our customers. Gateway employees understand that there may be a time when your computer makes you feel a little weak in the knees. Never fear — our Midwestern people know the importance of a friendly voice and a helpful attitude on the other end of the phone.

Every Gateway system comes with excellent after-the-sale support. You get a **30-day money-back guarantee**. So, if you're not completely satisfied with your system, you can send it back within 30 days for a refund.

All Gateway 2000 systems have a **one-year limited warranty** and telephone **technical support for the life of the system**. When you need help with your PC, you want someone who will jump through hoops to help you. That's what you'll get with our support departments.

Gateway's **automated fax service** will supply you with detailed documentation on over 150 technical subjects. You'll also get a **lifetime BBS membership** for additional technical support and on-line forums.

We offer **on-site service** to most locations in the country (factory service only for notebooks). And **replacement parts** leave our factory as quickly as possible; we pay overnight shipping. For details on our guarantee, warranty and on-site service programs, please call for a free written copy of our policies.

We also make it easy for you to buy a Gateway PC, with **convenient payment options** including major credit cards and C.O.D. terms. Net 30-day terms and leasing options are also available to qualified commercial customers.

Energy Star Program

The Environmental Protection Agency's Energy Star Program is fast becoming the industry standard in the "green" movement. PCs and monitors with the Energy Star logo are capable of consuming 30 watts or less of electricity. All Gateway 2000 desktop systems, with the exception of our new Pentium-based PCs, are EPA Energy Star compliant.

Introducing The Gateway DuoLine MasterCard® Card

Here's another value-added way to get the latest technology: the Gateway 2000 DuoLine MasterCard now available only through Gateway 2000.

This innovative card enables you to make purchases from Gateway and anywhere else MasterCard is accepted, by giving you two lines of credit — one for Gateway purchases and one for all other purchases. For Gateway purchases, the card has no annual fee and a low variable interest rate of just 12.9% APR. For purchases elsewhere, you get a variable interest rate of 13.9% APR and a low \$18 annual fee.* If you already have a MasterCard, you may also apply for a Gateway DuoLine MasterCard. Lines of credit will vary by individual. For an application, call 800-846-1781.

*Cash advance fee is \$1 plus 2% of the amount of the cash advance, but not less than \$5 nor more than \$10. The Gateway 2000 DuoLine MasterCard is issued by Dial National Bank.



FOR YOUR WEAKEST MOMENTS

At Gateway 2000, we strive to be extremists when it comes to bringing you the **highest**-performance systems, with the **most** features at the **lowest** prices...for the **greatest** value in the PC industry. We are committed to giving you the **strongest** after-the-sale support. And we will continue to find the "**greenest**" ways to increase energy efficiency and protect the environment. Call your Gateway 2000 sales representative today!



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...a Gateway...



GATEWAY 2000'S COOLEST PCS

4SX-33

- Intel® 25MHz 486SX Processor
- 4MB RAM
- 3.5" Diskette Drive
- 212MB 13ms IDE Hard Drive
- Intel Pentium™ Technology Ready
- Local Bus Graphics Accelerator w/ 512KB DRAM
- 14" Color CrystalScan® 1024NI
- New Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard
- Microsoft® Mouse
- MS-DOS®/Windows™ & Tools
- MS Works for Windows™ 2.0
- EPA Energy Star Compliant

\$1295 4SX-25 \$1275

4DX-33

- Intel 33MHz 486DX Processor
- 4MB RAM
- 3.5" Diskette Drive
- 212MB 13ms IDE Hard Drive
- Intel Pentium Technology Ready
- Local Bus Graphics Accelerator w/ 512KB DRAM
- 14" Color CrystalScan 1024NI
- New Mini Desktop Case
- 5 16-Bit ISA Slots
- 101-Key Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- MS Works for Windows 2.0
- EPA Energy Star Compliant

\$1495

4DX2-50

- Intel 50MHz 486DX2 Processor
- 4MB RAM, 128KB Cache
- 3.5" Diskette Drive
- 424MB 13ms IDE Hard Drive
- Intel Pentium Technology Ready
- Local Bus Graphics Accelerator w/ 1MB DRAM
- 14" Color CrystalScan 1024NI
- New Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey® Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- Choice of Application Software
- EPA Energy Star Compliant

\$1795

4DX2-66

- Intel 66MHz 486DX2 Processor
- 4MB RAM, 128KB Cache
- 3.5" Diskette Drive
- 424MB 13ms IDE Hard Drive
- Intel Pentium Technology Ready
- Local Bus Graphics Accelerator w/ 1MB DRAM
- 14" Color CrystalScan 1024NI
- New Mini Desktop Case
- 5 16-Bit ISA Slots
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- Choice of Application Software
- EPA Energy Star Compliant

\$1995

4SX-33V

- Intel 33MHz 486SX Processor
- 4MB RAM
- 5.25" & 3.5" Combo Drive
- 212MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- VLB Graphics Accelerator w/1MB DRAM
- 14" Color CrystalScan 1024NI
- New Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- Choice of Application Software
- EPA Energy Star Compliant

\$1495

4DX-33V

- Intel 33MHz 486DX Processor
- 8MB RAM, 128KB Cache
- 5.25" & 3.5" Combo Drive
- 424MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- VLB Graphics Accelerator w/1MB DRAM
- 14" Color CrystalScan 1024NI
- New Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- Choice of Application Software
- EPA Energy Star Compliant

\$1995

4DX2-50V

- Intel 50MHz 486DX2 Processor
- 8MB RAM, 128KB Cache
- 3.5" Diskette Drive & CD-ROM
- 424MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- VLB ATI™ Ultra XLR 2MB Graphics
- 15" Color CrystalScan 1572FS
- New Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- Choice of Application Software
- EPA Energy Star Compliant

\$2295

66MHz Best Buy

- Intel 66MHz 486DX2 Processor
- 8MB RAM, 128KB Cache
- 3.5" Diskette Drive & CD-ROM
- 424MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- VLB Graphics Accelerator w/1MB DRAM
- 15" Color CrystalScan 1572FS
- New Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- Choice of Application Software
- EPA Energy Star Compliant

\$2495

4DX2-66V

- Intel 66MHz 486DX2 Processor
- 16MB RAM, 256KB Cache
- 3.5" Diskette Drive & 2X CD-ROM
- 424MB 13ms IDE Hard Drive
- Local Bus IDE Interface
- Intel Pentium Technology Ready
- VLB ATI Ultra XLR 2MB Graphics
- 15" Color CrystalScan 1572FS
- New Baby AT Case
- 5 ISA & 2 VESA/ISA Slots
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- Choice of Application Software
- EPA Energy Star Compliant

\$2995

P5-60 Best Buy

- Intel 60MHz Pentium™ Processor
- 8MB RAM, 256KB Cache
- 3.5" Diskette Drive & 2X CD-ROM
- 424MB 13ms IDE Hard Drive
- PCI ATI Ultra XLR 2MB Graphics
- 14" Color CrystalScan 1572FS
- New 300W Tower Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- MS Works for Windows 2.0

\$2995

P5-60

- Intel 60MHz Pentium™ Processor
- 16MB RAM, 256KB Cache
- 3.5" Diskette Drive & 2X CD-ROM
- 528MB 12ms IDE Hard Drive
- PCI ATI Ultra XLR 2MB Graphics
- 17" Color CrystalScan 1776FS
- New 300W Tower Case
- 4 ISA, 2 PCI & 1 PCI/ISA Slots
- 124-Key AnyKey Keyboard
- Microsoft Mouse
- MS-DOS, Windows & Tools
- Choice of Application Software

\$3995

Software Choices

If a system comes with "choice of application software," choose one of the following packages:

- Microsoft Excel for Windows™
- Microsoft Word for Windows™
- Microsoft Word and Bookshelf®92, CD-ROM Edition
- Microsoft PowerPoint for Windows™
- Microsoft Project for Windows™
- The MS Entrepreneur Pack(Works, Publisher, Money, and games)
- Borland Paradox® and Quattro®Pro for Windows

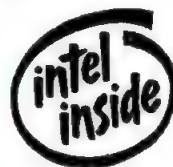
Due to the volatility of the DRAM market, all prices are subject to change.



Printed on recycled paper with soy inks.



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AND THE HOTTEST

SOFTWARE & PERIPHERALS

SOFTWARE

Microsoft Office™— You can upgrade from a choice of application software to Microsoft Office, CD-ROM version, for only **\$99!** This single package has all the leading Windows applications: Word, Excel and PowerPoint.

Choice of Application Software—If the system you want comes with MS Works for Windows, you can upgrade to a choice of application software for only **\$100.**

COMMUNICATIONS

■ TelePath™ II Fax/Modem

Internal fax/modem, 14,400bps modem, V.32bis, with 9,600bps fax capability. Package includes data and fax communication software plus a CompuServe® trial membership. **\$159**

■ Cardinal® 2400 Fax/Modem

Internal fax/modem, 2,400bps modem, V.22bis, with 9,600bps fax capability. Package includes QModem and WinFax Lite. **\$49**

■ Intel EtherExpress™

The one board you can use for all your Ethernet adapter needs. Providing 8- and 16-bit support for twisted-pair, thin-and-thick-wire Ethernet cabling, it sets a new performance standard for 16-bit LAN adapters by providing full support for standard network operating systems.

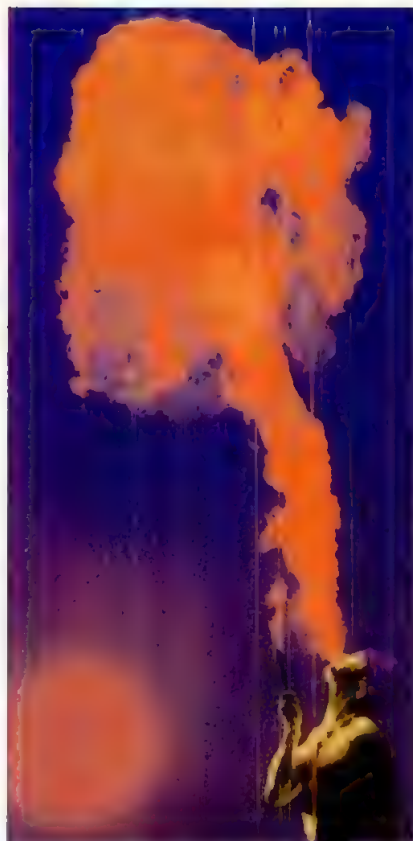
\$105 Twisted Pair or BNC Kit (BNC Kit includes cable, connector, terminator and card)

■ Gateway 2000 Ethernet Adapter

This third-generation adapter manufactured by 3Com features parallel tasking architecture which speeds up packet processing and improves adapter performance. Plus, its high level of integration greatly reduces the number of discrete components, lowering cost and increasing reliability.

\$105 Twisted Pair

\$125 BNC Kit (includes cable, connector, terminator and card)



■ Colorado Memory Systems™ TBU

250MB internal automatic tape backup unit copies up to 9.5MB per minute with high-speed data compression. Comes with easy-to-use DOS software, one tape and cable. **\$175**

MONITORS

■ CrystalScan® 17-Inch Monitors

Non-interlaced, color monitor. If your system comes with a 14-inch monitor, you can upgrade to this monitor for \$600. If your system comes with a 15-inch monitor, you can upgrade for **\$520.** (Prices good only for upgrades at the time of system purchase.)

■ Gateway CrystalScan 2076LE

This high-performance, 20-inch, 30 dot pitch color monitor is perfect for CAD, imaging and graphic design. It has a maximum resolution of 1280 x 1024 at 80Hz refresh, plus it features a Trinitron CRT and Super Fine Pitch™ aperture grille for bright images and vibrant colors. You can upgrade to the 20-inch monitor for **\$1,590** if your system comes with a 14-inch monitor. If your system comes with a 15-inch monitor you can upgrade for **\$1,510.** (Prices good only for upgrades at the time of system purchase.)

PRINTERS

■ Panasonic® KX-P2123

Color-Capable Printer

Add color to your documents with this 24-pin dot matrix printer. Includes Adobe Type Manager.®

KX-P2123 **\$259**

KX-P2123 Color Option **\$50**

■ Epson® Stylus™ 800 Ink Jet Printer

Great laser quality at an even greater value.

Measuring only 17 inches by 10.5 inches, the Stylus 800 has 7 different typefaces and prints an extra-quiet 150 characters per second at 360 dpi. Parallel cable included.

Gateway 2000 Price **\$339**

Epson Mail-in Rebate* **-\$50**

After Rebate Cost **\$289**

*Your mail-in rebate will be delivered with your Epson printer. This special price is only good for orders taken through October 31, 1993.

Epson ActionLaser 1500 Laser Printer

Superior output in a high-quality laser printer. The ActionLaser delivers professional-quality printouts with crisp, sharp images, black blacks and smooth, "jag-free" lines. It also features a fast six-page per minute print speed, 14 resident fonts, 300 x 300 dpi, and 1MB memory expandable to 5MB. Parallel cable included. **\$669**

The software and peripherals listed here are sold only with the purchase of a system. For details on our complete line of extras for Gateway customers, ask for our special add-on components division when you call.

We offer many other system options and upgrades. Call today!

SERVICE

Every Gateway 2000 system is backed by:

- 30-Day Money-Back Guarantee
- One-Year Limited Warranty
- Lifetime Toll-Free Technical Support
- On-Site Service Available to Most Locations
- Lifetime BBS Membership
- FaxBack™ Automated Fax Service

Details about our warranty, guarantee and on-site service program are available upon request.



Tools on Top™ is now included on all Gateway 2000 mini desktop, desktop and tower systems. Program includes file manager, desktop and emergency disk portions of Central Point's award-winning PC Tools for Windows.



Multimedia

\$149 SST Helps You Master Complex Multimedia Presentations

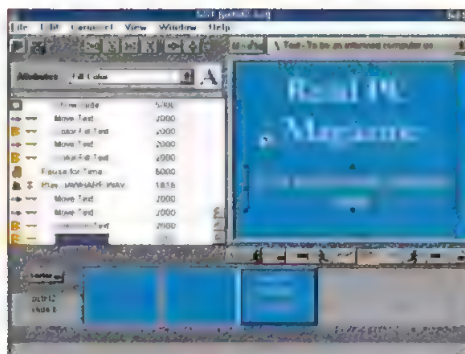
BY MARK BROWNSTEIN

Unlike many other multimedia presentation products for Windows, Ask Me Multimedia Center's \$149 SST has clearly been designed for the nonexpert who wants to create interesting presentations but won't take the time to suffer through the process.

SST uses a slide-show metaphor in which each screen is a

slide and a collection of slides is placed in a carousel. And like slides in a carousel, SST's slides can be rearranged using a slide sorter. In edit view, you can see your current slide and two slides on either side. Running a presentation is as easy as starting a slide show.

But these are no ordinary slides. Text, images (.BMP, .DIB, .GIF, .PCX, .TGA, and TIFF formats), sounds and ani-



MAIN SCREEN: *Full presentation control.*

entry and exit effects, and then you apply a background graphic. Next you place your text, graphic, image, or sound elements on the screen in the order that you want them to appear.

Every element can have an associated action. Both text and

mations (.AVI, .FLC, and .FLI formats) are all acceptable. If your hardware supports it, .WAV sounds and MIDI music can play concurrently, too.

To create a slide, you first select a background color and

images can move from one place to another. A car, for example, can look like it's driving into the distance if you simultaneously move it and reduce its size. Modifying such actions is easy.

SST really shines in the ease with which you can move text or graphics, change colors, and resize text or graphics—all without programming. To move a block of text, for example, you just highlight the text, select Move from the Actions menu, and drag the text to its destination (a destination can even be off-screen). Once you release the mouse, the move is stored in the slide's action list.

SST supports hot buttons, letting you define branching inside a presentation to create interactive presentations. You can even branch to another "carousel" to run a new series of slides.

For all its strengths, SST is clearly a first release. Its basic drawing tools let you draw and size only circles, rectangles, and ellipses. It doesn't come on a CD-ROM and isn't shipped with lots of sample files. But SST gives you the tools you need to make impressive, interesting presentations, and using it is easy enough to make you feel encouraged to try new things.

• List price: *SST, \$149*. Requires: 2MB RAM (4MB recommended), 10MB hard disk space, Microsoft Windows 3.1. Ask Me Multimedia Center, 7100 Northland Circle, #401, Minneapolis, MN 55428; 612-531-0603; fax: 612-531-0645.

Circle 422 on reader service card

■ Database Reporting

Impromptu Is for Both MIS and End Users

BY RON ANDERSON

By including features that will make both MIS staff and end users happy, Cognos Corp.'s Impromptu is carving a niche for itself in the crowded database reporting field. Impromptu Administrator Edition, \$595, provides the tools that MIS staff need to present corporate data to end users in a secure, easy-to-use package. The Enterprise Edition, \$495, gives end users GUI-based tools for querying and presenting information in reports the way they want them to look.

Impromptu supports SQL-based information systems from Oracle, Sybase, and Microsoft SQL Server, or any database with an ODBC (Open Database Connectivity) driver. dBase and Paradox files are also supported.

Administrator Edition users, usually corporate MIS staff or departmental power users, cre-

ate catalogs of data and custom reports. Catalogs contain all of the information necessary to join relational tables so end users never need to know the particulars of the database schema. The catalog also controls the joins permitted and the cost of performing a particular query. This is a nice feature that can prohibit queries that would require exceptionally large database and

[illegible]

DATA NET: *A state-of-the-art interface.*

network resources.

Enterprise Edition users create reports from catalogs. Impromptu protects end users from the intricacies of SQL (Structured Query Language) by giving them a click-and-drag view of corporate data. Canned re-

ports, created by Administrator Edition users, can be used as is or modified. End users can also create their own custom reports in an interactive environment. The catalogs present columns of data to users without reference to tables or joins. End users pick and choose from the available columns of data, and Impromptu takes care of generating the SQL statements.

By including tools for MIS professionals and end users alike, Cognos has positioned Impromptu as the database reporting tool for everyone (as long as everyone uses Windows). MIS professionals will enjoy being relieved of the endless task of writing and changing reports for end users, while end users will appreciate the ability to do their own reports.

• List price: *Impromptu Administrator Edition, Version 2.0*, \$595; *Impromptu Enterprise Edition*, \$495. Requires: 4MB RAM (6MB recommended), 2MB hard disk space, Microsoft Windows 3.1. Cognos Corp., 67 S. Bedford St., #100E, Burlington, MA 01803; 800-426-4667, 617-229-6600; fax, 617-229-9828. Circle 420 on reader service card

Image Capture

Collage Adds Utilities To Its Screen Capture

BY EDWARD MENDELSON

Collage Complete combines a set of utilities for effectively capturing Windows and DOS screens with a separate utility that manages and modifies captured, scanned, or imported images. Earlier versions of Inner Media's \$149 package (before Complete became part of its name) included only the image-capture software. You had to go elsewhere to manipulate the images.

Among dozens of capture programs on the market, Collage stands out for its ability to capture the most elusive screens. The Collage Windows capture program, like rival packages, can capture all screen sizes at any color depth up to 24 bits and 16.7 million colors. But the DOS program is unique in its ability to capture the "graphic fonts" that give programs like PC Tools for DOS and The Norton Utilities their quasi-graphic look.

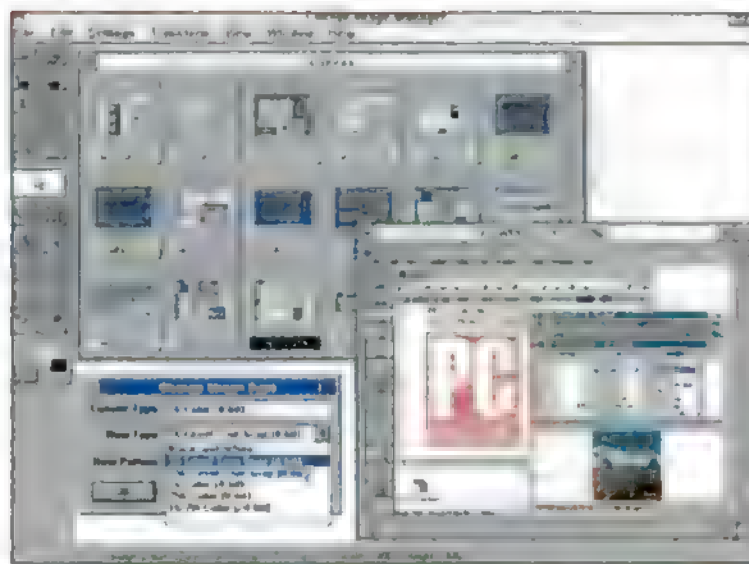
The Windows utility lets you capture all or part of a screen by pressing a hotkey or, for hands-off captures, by starting a timer. You can preview and crop images immediately after capture or save them to disk for later processing.

The new Windows-based image management utility lets you catalog thumbnail versions of your graphic files, convert among a dozen major formats, and perform rudimentary image editing by adding text or lines, erasing pixels, and altering colors. The program also reads images from Kodak Photo CD disks and scans images directly from Twain-compatible scanners.

Compared to U-Lead's Image Pals, Collage Complete lacks advanced features and loads images more slowly, but it still provides useful basic func-

tions like adding borders to an image. You can choose only one of three border thicknesses, but that's probably all you'll need for manuals and similar publications.

The DOS capture utilities consist of three terminate-and-stay-resident programs with varying feature sets. If you don't need all the functions of the largest program, you can save RAM by using one of



CATALOG: Collage Complete includes an image manager and cataloguer.

the smaller ones. The largest needs 16K of conventional RAM; it lets you capture, view, and manage screens and set the color palette. You also get a

basic standalone DOS image viewer.

Other graphics packages have richer features for working with scanned images, but Collage Complete remains an outstanding package for capturing and managing images of the screen.

• **List price:** *Collage Complete*, \$149; upgrade, \$59. **Requires:** DOS version: 256K RAM, DOS 2.0 or later. Windows version: 4MB RAM, 2MB hard disk space, Windows 3.1. *Inner Media Inc.*, 60 Plain Rd., Hollis NH 03049; 800-962-2949, 603-465-3216; fax: 603-465-7195. Circle 417 on reader service card

Utilities

ClickBook Prints Incredible Shrinking Documents

BY STAN MIASTKOWSKI

Lugging around long-winded memos and reports is a fact of business life. But ClickBook makes life "lite." This \$69.95 utility turns your printed output into a variety of portable forms. A 24-page memo can become a handy folded booklet that uses six sheets of paper.

ClickBook works with any Windows application and any printer that handles single-sheet feed. You can choose from 18 different formats ranging from plain-vanilla full-size double-side printing to a wallet-sized book that compresses 24 pages of document onto a single sheet of paper. You can turn your computerized contact list into a transportable booklet or transform reams of spreadsheets into a hand-sized report.

ClickBook works with your existing Windows print driver, creating a copy during the installation process and modifying it to handle scaling and double-side printing. Since printers—especially lasers—all feed paper through different torturous paths, ClickBook cleverly fig-

ures out the idiosyncrasies of your printer through a step-by-step process. You print a test document twice, and click on a graphic that matches the print output.

You use your Windows applications in the usual way; ClickBook scales pages to fit the format at print time. Small-page formats require a bit of thought and experimentation. Different fonts and sizes make big differences in readability.

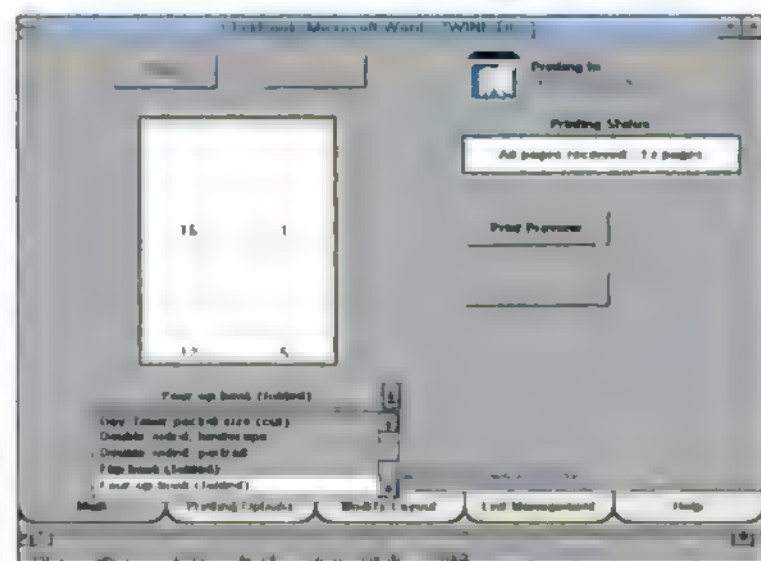
After the first pass through the printer, ClickBook prints a "Guide Sheet"

with a large arrow that shows you how to reinsert the paper for the second pass. After that's done, the Guide Sheet includes step-by-step instructions for cutting, folding, and stapling your book.

Printers that don't usually handle double-side printing can be finicky. We found that inexpensive copy paper tended to

jam on the second pass through both a Lexmark 4029 and an HP LaserJet Plus, especially if the paper was stored under less than optimal conditions.

You won't want to use ClickBook for self-publishing your Great American Novel; books longer than 50 pages or so get a bit unwieldy and require special stapling equipment. But for saving paper and making virtually any kind of document easy to handle, ClickBook is a great utility that's



LESS-PAPER OFFICE: There are 18 different formats for your tiny portable documents.

stunningly easy to use.

• **List price:** *ClickBook*, Version 1.0, \$69.95 (\$49.95 through December 31). **Requires:** 2MB RAM, Microsoft Windows 3.1. *BookMaker Corp.*, 625 Emerson St., #200, Palo Alto, CA 94301; 800-766-8531, 415-617-1101; fax 415-323-0108.

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■ Communications

Vomax 2000: All-in-One Comm Solution Is Less than the Sum of Its Parts

BY JOHN R. QUAIN

Among the various all-in-one products that try to bring telephony to the PC is Macronix's \$479 Vomax 2000. Shaped like a standard phone-answering machine, the Vomax is a digital voice answering machine with a built-in fax/modem. Unfortunately, its various features don't compare well to those available from less expensive components.

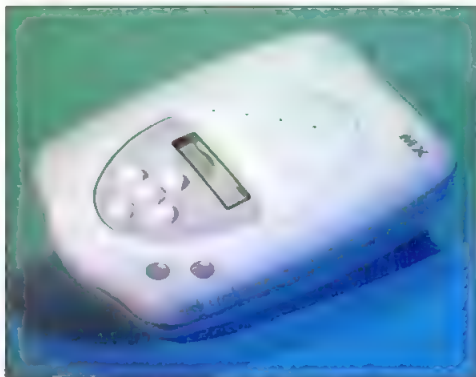
The Vomax comes with two RJ-11 phone jacks and a standard serial port. A small LCD panel on the front indicates what mode the machine is currently in and how many messages

you've received. Internally, the Vomax contains 1MB of memory, which it distributes among the answering machine, 9,600-bps fax, and 2,400-bps modem.

Even though the system works well enough, the Vomax's

answering machine doesn't offer many advantages over standard machines in terms of convenience. You'll still have to read the instructions carefully to record outgoing messages and delete old calls. And the digital approach, while superior in many ways to audio cassette tape, limits the Vomax to about 20 minutes of voice messages.

One advantage of Vomax's voice answering-machine solution is that it can forward calls to another number or alert a pager. It can also automatically distinguish between incoming voice and fax calls. However, it lacks the ease of use that similar products, such as



IN ONE PLACE: The Vomax 2000 includes a digital answering machine and fax modem.

the Complete Communicator, offer.

The 9,600-bps fax portion of the Vomax machine is easier to use. It's Group III fax compatible, and the accompanying DOS-based Macronix software does an adequate job of sending files in various formats, including WordPerfect, WordStar, and the PCL print format.

On the modem side, the Vomax 2000 is a little out of date. It supports MNP 5-7 data compression, MNP 4 error correction, and is Hayes compatible, but at only 2,400 bps it's slow. Tradewinds Software's COMit data communications software is included, but it's behind the times, too, supporting the Xmodem and Ymodem protocols, but not Zmodem.

• List price: *Vomax 2000*, \$479. Requires: 2MB RAM, 3MB hard disk space, and DOS 3.1 or later. Macronix Inc., 1338 Ridder Park Dr., San Jose, CA 95131; 800-858-5311, 408-453-8088.

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■ Statistics

SPSS 6.0: Bigger and Better For Hard-Core Statistics

BY JAMES KARNEY

SPSS was one of the first major statistics software packages to make the move to Windows, and its excellent graphical interface and wide range of features have won it acclaim. Now SPSS Inc. has come up with plenty of improvements for the \$695 SPSS for Windows 6.0. The new version has 58 new functions, 50 new charts (twice as many as the last release), and four new optional modules.

SPSS's foundation is the base module, supplying menus, an Excel-like data entry window, and a report generator. You can use either dialog boxes or the SPSS command language to run procedures. Among the new statistical functions are continuous and discrete distributions such as Pareto, chi-square, Cauchy, and

uniform; random number generation; Bernoulli; hypergeometric functions; and negative binomials. The new charts center on statistical quality control (SQC) and diagnostic plots.

You add optional modules to the basic product and use them through the same interface. The Trends module focuses on time-series analysis; CHAID handles categorical and ordinal data; QI is a statistical process control tool; and MapInfo offers an easy way to link and display data in geographical form.

The new version has improved OLE support as well as the ability to use data directly from any application compatible with Microsoft's Open Database Connectivity (ODBC) and Messaging Application Interface. That means you can e-mail charts and reports directly from SPSS.

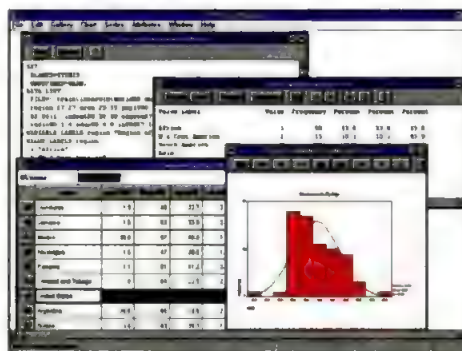
SPSS's speed is virtually unchanged from the older version. Most of our tests took 10 seconds or less on a data set containing up to 10,000 cases and 6 variables. In general, doubling the number of cases doubled processing time. More intensive calculations (such as running K-means clusters) took several

Statistical Association (September, 1967, by J.W. Longley), and found only the most minor of errors.

The only complaint we have is one we've made before. Formatting in the report writer is very limited. If you plan to use anything other than basic system fonts, expect to spend a lot of

time playing with the output in other programs. That one drawback aside, SPSS is a heavy-duty tool for anyone working with statistics.

• List price: *SPSS 6.0 for Windows*, \$695 (basic product only). Requires: 4MB RAM, 20MB hard



MORE AND MORE: There are 58 new functions.

minutes on a 33-MHz 486 with 16MB RAM and Windows 3.1. We ran a variety of data sets designed to evaluate statistical packages, including one listed in the Journal of the American

disk space, Microsoft Windows 3.1. SPSS Inc., 444 N. Michigan Ave., Chicago, IL 60611; 800-543-9262, 312-329-2400; fax, 312-329-3668.

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What Lotus doesn't want you to know about new Quattro Pro 5.0

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1. *Not!*
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10. *Not!*

Shhhhhh! Lotus has a secret they don't want anyone to know. Quattro® Pro consistently ranks as the #1 spreadsheet in virtually every head-to-head comparison with both 1-2-3 and Excel. Take *PC Week's* September review where Quattro Pro beat 1-2-3 in four out of five categories. Or *PC Magazine's* annual customer satisfaction study where "Lotus lost the crown for overall satisfaction to both the DOS and Windows versions of Quattro Pro . . ."

Quattro Pro keeps winning because it has more power, more analysis tools, and is easier to learn and use. And now there are three brand new versions of Quattro Pro 5.0 (Windows, DOS, and Workgroup Edition) that are even better. The chart shows you how Quattro Pro's Workgroup Edition offers you built-in capabilities not found in Lotus 1-2-3 for Windows Release 4.

Now we'll let you in on *our* little secret. We want every Lotus user to try Quattro Pro, so we are making incredible introductory offers on all new versions of Quattro Pro. Sorry, Lotus, the secret is out.



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Monitors

Nokia's Multigraph 445X: A New Display Heavyweight

BY WINN L. ROSCH

First impressions count most, and Nokia Consumer Electronics makes a big one with its Multigraph 445X color display. It's big in every way: 70 pounds, 21 inches, and \$3,225.

The Finnish company's monitors have been sold here under other names, by other vendors, since 1982. The 445X is part of Nokia's new strategy to establish its own name in the U.S. market. The monitors include 14-, 15-, and 17-inch displays.

The 445X's big screen is extremely sharp. Thanks to a dot pitch of 0.26 mm and 200-MHz bandwidth, the 445X displays at 1,600 by 1,200-pixel noninterlaced resolution and has an eye-pleasing 80-Hz refresh rate. Its flat-square tube is antiglare treated and uses an Invar shadow mask.

The 445X is like a crystal ball for new technologies that will certainly appear in other, more modest monitors in the future.

Unlike most of today's uninspired on-the-monitor controls, the 445X uses a control system much like that of today's TVs and VCRs: on-screen menuing.

The 445X's control menu includes an intuitive four-button control scheme. Two buttons select function; two raise or lower settings that include brightness, contrast, positioning, size, color temperature, and even degaussing. The on-screen read-out is stable at all resolutions. Internal memory stores 28 setting combinations.

GOING THE EXTRA PHOTON

While other monitor makers aspire to the strict MPR-2 radiation standard, the 445X goes a step further—to the new level set by the Swedish union TCO. Thanks to a double-saddle yoke and metal cage inside the big

plastic case, the 445X emits virtually no measurable magnetic or electrical radiation.

The 445X also beats the Energy Star standards, dropping down from its normal 130 watts of power consumption to a 15-watt standby mode when your screen-saver blacks out the screen for more than 3 minutes. If the 445X emits no image for more than an hour, it automatically powers down. Press a key on your keyboard and the 445X

relights from standby mode in a few seconds, but recovering from automatic power-down takes the full warm-up period (about 20 seconds).

The 445X comes with a 6-foot cable that adapts its BNC inputs to a standard 15-pin VGA jack, syncs with signals from 50- to 120-Hz vertical and 30- to 102-KHz horizontal, and works with just about any graphics adapter (though few can tap all of the 445X's abilities). Just make sure your desk is strong enough that the weighty 445X doesn't make a big impression in it, too.

• List price: *Nokia Multigraph 445X*, \$3,225; *Nokia Consumer*



THE MULTIGRAPH 445X: Big and heavy, but not dull.

Electronics, 3000 Bridgeway Blvd., Sausalito, CA 94965; 415-331-0322; fax, 415-331-0424.

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Spreadsheets Utilities

Gaze Into Crystal Ball for Fast Spreadsheet Forecasting

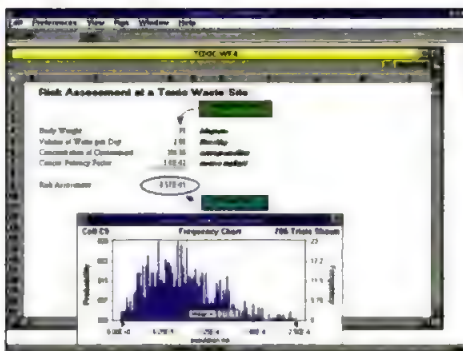
BY CRAIG STINSON

Crystal Ball, the highly graphical \$195 risk-management add-in from Decisioneering Inc., is now available for Lotus 1-2-3, Release 4 as well as for Microsoft Excel, Version 4. The newly issued Version 3.0 also includes a smattering of welcome improvements over its predecessor.

Crystal Ball is designed to quantify the uncertainty inherent in any spreadsheet forecast. For each variable affecting the forecast, you supply a distribution type and certain parameters required by that distribution type. For example, if a cost factor in your model has a single likeliest value, with probabilities falling off evenly above and below that value, you would choose a triangular distribution and indicate the most probable value, the lowest possible value, and the highest possible value.

Crystal Ball supports 15 standard distribution types (plus a custom "roll your own" type), and its manual provides exceptionally lucid information about the appropriateness and characteristics of each.

Once you've described the nature of your model's uncertainties and indicated which output ("forecast") cells are of interest, you run a simulation.



NO CHANCES: Crystal Ball meets 1-2-3, Release 4.

Crystal Ball plugs numbers randomly into each variable and measures the effects at each iteration. You may run as many trials as you please and choose from two sampling methods—Monte Carlo and Latin Hyper-

cube. On completion, or at selected intervals during the run, the add-in plots its results, showing the probability of any particular outcome. (The graphs are proprietary, not those of the host spreadsheet, and the communication with the host is via DDE.)

In this newest version, Crystal Ball also offers sensitivity measurement, quantifying the degree to which each variable affects each forecast cell. This information helps you eliminate variables that don't matter and focus more attention on those that do.

You can also save and restore simulations; run your own macros before, after, and between the iterations of a simulation; drive Crystal Ball itself via macro; and access the probability distribution functions used by Crystal Ball. Programmers can now make Crystal Ball the engine for custom applications without exposing users to Crystal Ball's own menus and dialog boxes.

• List price: *Crystal Ball, Version 3.0*, \$295. Requires: 2 MB RAM, (4MB recommended), 1MB hard disk space. *Excel, Version 4.0* or *Lotus 1-2-3, Release 4* for Windows. *Decisioneering Inc.*, 1380 Lawrence St., #520, Denver, CO 80204; 800-289-2550, 303-292-2291; fax, 303-534-2118.

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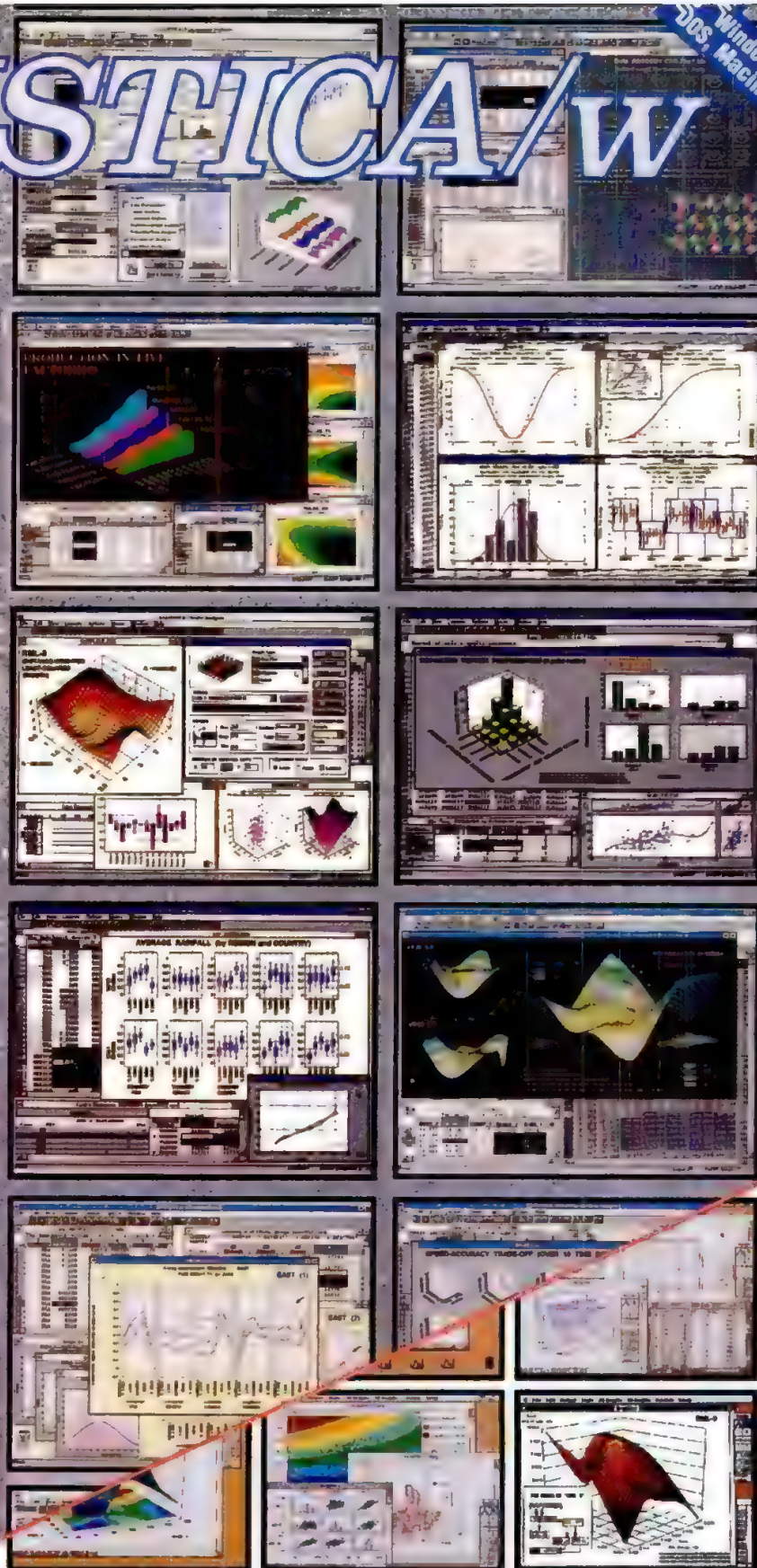
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NEWS OF ANNOUNCED PRODUCTS AND UPGRADES

By Brad Grimes

NEW

Canon Cuts the Cost of Printing in Color

Canon Computer Systems' fall announcements include the Canon Bubble Jet Printer BJC-600, a low-cost color printer, and the Canon Laser Printer LBP-430, an energy-efficient laser printer aimed at the small- and home-office markets. The \$719 BJC-600 is a revolutionary 360-dpi color printer whose integrated printhead has four 64-nozzle print-heads—one for each color: cyan, magenta, yellow, and black. At a cost of between \$7 and \$8 each, you simply replace one of the colors rather than the entire printhead. With 64 nozzles dedicated to each color, 24-bit screen matching, and a multipass mode that reduces banding, the BJC-600 can produce excellent color output.



Canon's new low-cost Bubble Jet printer, the BJC-600.

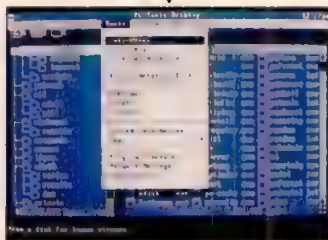
The \$799 LBP-430 is a 300-dpi monochrome laser printer with a rated speed of 4 pages per minute. It uses Canon's Automatic Image Refinement technology and superfine toner to improve print quality. The engine that's used in the LBP-430 sets new standards for energy conservation. The printer has no on/off switch; it's asleep until it receives a print request, then goes back to sleep when the job is complete, using less than 5 watts of power while powered down—the same amount your TV uses when turned off. There's also no warm-up time, so print jobs are handled much faster.

• List price: Canon Bubble Jet Printer BJC-600, \$719; Canon Laser Printer LBP-430, \$799. Canon Computer Systems Inc., 2995 Redhill Ave., Costa Mesa, CA 92626; 800-848-4123, 714-438-3000; fax, 714-438-3099.

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Photography by Thom O'Connor

HOT PROSPECT



Central Point PC Tools for DOS Is Now Lean and Mean

Central Point Software decided that its PC Tools for DOS had gotten over-stuffed. So it has taken out what you can live without and has named the new version Central Point PC Tools Pro for DOS. The trimmed fat includes the appointment scheduler, the calculators, the notepads, Commute, fax support, and more. The most essential elements—Anti-Virus, Backup, FileFix, plus utilities for disk optimization, formatting, and system information—are still there.

But there are also powerful enhancements like the new CPR utility that automatically saves your session to the hard disk in case of a system crash. That way you can start up where you left off simply by typing CPR. PC Tools Pro also comes with Central Point Anti-Virus 2.0, which includes Virus Analyzer and SmartChecks features. What's more, the new PC Tools supports Stackcr, DoubleSpace, and PKZip 2.x. It also comes with new WordPerfect 6.0 and Microsoft Word for Windows file viewers.

For a limited time, Central Point will offer PC Tools Pro for \$99.95. Users of previous versions of PC Tools or of various competitors can upgrade for \$49.95.

• List price: Central Point PC Tools Pro for DOS, \$179.95. Central Point Software Inc., 15220 N.W. Greenbrier Pkwy., #150, Beaverton, OR 97006; 800-964-6896, 503-690-8088; fax, 503-690-8083.

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NEW

Compaq Takes the Plunge Into Pen Computing With the Concerto

Compaq Computer Corp. has announced its first attempt at a pen-based notebook PC: the Compaq Concerto. The Concerto comes in 25- and 33-MHz 486SL flavors, with a 120MB or 250MB hard disk, 4MB RAM, a 9.5-inch monochrome display, and two Type II PCMCIA slots. It has a built-in carrying handle that doubles as a display stand when you separate the display from the slimline keyboard. If you don't need the keyboard, it can be completely detached, and you can use the Concerto display as a tablet. The pen that comes with the Concerto can be used as either a pointing or an input device, and Compaq ships two pen applications, InkWare NoteTaker and PenPower for Excel, to get you started.

• List price: Compaq Concerto, starting at \$2,499; Compaq Computer Corp., P.O. Box 692000, Houston, TX 77269-2000; 800-345-1518, 713-378-8820; fax, 713-378-1442.

Circle 403 on reader service card

IMPROVED

Windows Sound System 2.0 Is Hardware-Independent

Because users wanted Microsoft Windows Sound System capabilities with existing audio boards, Version 2.0 of the Sound System comes in two bundles: one with just software and a microphone; another with software, microphone, headphones, and a 16-bit audio card. Microsoft Corp.'s most obvious enhancement to the Sound System is the new standing, directional microphone that's been optimized for better voice recognition and hands-free operation. Version 2.0 is hardware-independent, so if you have a third-party audio board you can still run Sound System.

The Voice Pilot speech recognition software now affords greater accuracy with 256 words active at one time and an unlimited capacity for total words in its dictionary. The Quick Recorder compresses voice files to one-tenth their original size, and the Sound Editor lets you manipulate the files. The ProofReader function is useful for converting spreadsheet data to

New & Improved

speech, and the Sound Finder incorporates OLE drag-and-drop for incorporating sound and voice files in OLE clients. Microsoft will offer the Windows Sound System, Version 2.0, at an introductory price of \$219.

• List price: *Microsoft Windows Sound System, Version 2.0*, \$289; software only, \$79. Microsoft Corp., One Microsoft Way, Redmond, WA 98052-6399; 800-426-9400, 206-882-8080; fax, 206-936-7329.

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IMPROVED

DaVinci eMAIL 2.5 Integrates An Administrative GUI

Version 2.5 of **DaVinci Systems Corp.**'s DaVinci eMAIL system was designed with the administrator in mind. Both the DOS and Windows versions now have Administrative GUIs that make everyday tasks like adding and deleting users as easy as clicking on a button. Administrative chores that used to require utilities, like fix address book and purge mailbox, have also been reduced to a single step. Version 2.5 fully supports Novell's Global MHS, integrates with NetWare 4.0, and provides two name synchronization solutions: Address Book Synchronization and Names Services.

For end users, DaVinci eMAIL 2.5 has a new 8.7K TSR that notifies you of incoming messages and a bulletin board feature that lets multiple users post and access messages from a single mailbox. Version 2.5 also supports multiple logins and comes with a host of new DOS viewers for such file formats as 1-2-3, Microsoft Excel, Microsoft Word, and WordPerfect.

• List price: *DaVinci eMAIL, Version 2.5, 10-user DOS and Windows Combo Starter Kit*, \$779. DaVinci Systems Corp., P.O. Box 17449, 4200 Six Forks Rd., Raleigh, NC 27609; 800-328-4624, 919-881-4320; fax, 919-787-3550.

Circle 406 on reader service card

NEW

Apple Targets Workgroups With Two New LaserWriters

Apple Computer has announced two new Apple LaserWriters, the LaserWriter Select 360 and the LaserWriter Pro 810, that are designed to meet the needs of small to large workgroups in mixed Macintosh and Windows environments. The Select 360 is a 600-dpi, PostScript Level 2 printer that's driven by an Advanced Micro Devices 16-MHz RISC processor to achieve 10 pages per minute of output. It has LocalTalk, parallel, and serial ports with auto-

BRIEFS

PRINTERS AND PLOTTERS

Alps Electric (USA) has introduced the ALPS LSX1000 (\$1,675), a low-cost 600-dot-per-inch laser printer with a rated print speed of 10 pages per minute. It's PostScript-compatible and has PCL 5e emulation. It comes standard with 2MB of memory, 83 resident fonts (including TrueType-compatible fonts), 10 bar code fonts, a slot for a LaserJet-compatible cartridge, and a PCMCIA slot for storing forms, backing up fonts and data, and installing flash memory. 800-825-2577, 408-432-6000.

Dataproducts Corp.'s new LZR 1580 and LZR 2080 PostScript Level 2 network laser printers (\$3,450 and \$4,795, respectively) incorporate the vendor's new Virtual Printer Technology for handling multiple network protocols simultaneously. Both use a Weitek 8200 RISC processor and 8MB of memory, and provide 800-dpi resolution. The LZR 1580 has a rated print speed of 15 ppm, while the LZR 2080 prints at 20 ppm. 800-334-3174, 818-887-8000.

Epson America is shipping the Stylus 300 thermal ink jet printer (\$349), a low-cost member of the Stylus family. The Stylus 300 prints at a maximum resolution of 360 by 360 dots per inch, and a speed of 110 characters per second in letter quality mode. It has an automatic, 100-page sheet feeder, six bitmapped and four scalable resident fonts, and an ink cartridge that is rated to last 700,000 sheets. 800-922-8911, 310-782-0770.

Genicom Corp. has introduced the Genicom Model 3940IP heavy-duty dot matrix printer (\$3,995) and the Genicom Model 7025 color thermal wax printer (\$995). The 600-character-per-second 3940IP accepts two different forms so you can switch print jobs without changing paper. The 7025 prints a page in 2.5 minutes at 203 dpi. It comes with Windows drivers and three-color, four-color, and monochrome ribbons. 800-443-6426, 703-949-1708.

I/O Software is offering the Kanji JetWriter SX-600 (\$4,995), a 600-dpi PostScript laser printer that's capable

automatic emulation and port switching built in, and it supports PCL 5 emulation. It also comes with a complete Apple Font Library with 64 fonts and support for TrueType and Adobe Type 1 fonts.

On the higher end is Apple's LaserWriter Pro 810, which supports up to 800 dpi at a maximum rate of 20 pages per minute. The LaserWriter Pro 810 has LocalTalk, Ethernet, and serial ports, automatic switching for mixed environments, and a built-in network card that allows printing over Ethernet networks using either IPX, TCP/IP, Ethertalk, or Digital LAT protocols. It comes with 64 scalable fonts, support for PostScript Level 2 and PCL 4+ page descriptions, and a standard paper capacity of 750 pages.

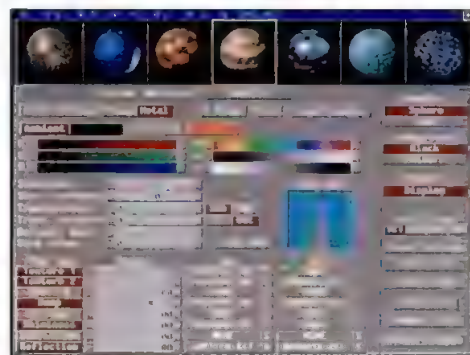
• List price: *Apple LaserWriter Select 360*, \$1,499 to \$1,799; *Apple LaserWriter Pro 810*, \$4,600 to \$5,000. Apple Computer Inc., 20525 Mariani Ave., Cupertino, CA 95014; 800-538-9696, 408-996-1010; fax 408-996-0275.

Circle 405 on reader service card

IMPROVED

Autodesk 3D Studio 3.0 Renders Like a Workstation

With Release 3.0 of its award-winning Autodesk 3D Studio modeling, rendering, and animation software, **Autodesk** is trying to match workstation performance. Rendering quality and speed have been enhanced, and workstation-like rendering features, such as a 64-bit Truecolor display space, an analytical image data processor for better anti-aliasing, and a display and rendering gamma correction



Studio 3D 3.0's Materials Editor now combines bitmaps to create unique textures.

function, have also been added. Release 3.0 also comes with a network rendering function that runs on any PC-based LAN and accesses up to 9,999 nodes simultaneously.

Other improvements include an enhanced Materials Editor with techniques for combining and layering bitmaps, and the ability to render

Pixels per second

1,600,000

1,400,000

1,200,000

1,000,000

800,000

600,000

400,000

200,000



WinBench™ 3.11 by Ziff-Davis Labs Tests Remote Windows™ Speed

This graph shows the speed of the three leading remote control programs when transferring Windows screens. As you can see, Close-Up handles more pixels, faster, meaning you spend less time waiting for Windows screens.

The industry standard test, WinBench 3.11, is perfect for testing the speed of remotes. It is an accurate measure of video throughput. Video throughput is the limiting factor in remote operations, because remote programs must transmit Windows video functions from one PC to the other.



New Remote Software Sets Windows Speed Record

Communicate Faster & Easier

Close-Up® lets you communicate faster & easier with five exciting technology firsts.

Close-Up is the only remote communications software that won both PC Magazine's coveted "Editors Choice" and PC World's "Best Buy" awards. Now Close-Up has a new faster & easier version that allows you to view and control another PC by modem as if you were there!

Technology Firsts

1. AI Video Compression
2. Photographic Memory
3. Non-Intrusive Technology
4. Expert System
5. Video Translation

Why Is Close-Up So Fast?

Close-Up learns as it works. It uses AI (Artificial Intelligence) to compress all Windows video function calls. That's why Close-Up does so well in Windows

Benchmark tests (see WinBench 3.11 chart).

Close-Up uses its revolutionary Photographic Memory™ so that once Close-Up

has seen all or part of a Windows screen, it's memorized. Then as screens change, Close-Up only transmits new unmemorized data. Incredibly, with this technology Close-Up gets faster & faster the longer you use it.

What Remote Companies Haven't Told You

Other remote programs permanently slow Windows and usually reduce your video resolution and depth of color, even when they are not in memory. That's because they permanently change your system.ini file. Close-Up's breakthrough Non-Intrusive Technology does not modify any of your sensitive Windows files including the system.ini. Close-Up is the only remote that when not in use, allows Windows and your PC to run at normal optimal levels.

Expert System Makes Communications Easy

You don't have to be a communications expert to get the results of one. Close-Up has an Expert System that automatically analyzes system components and configures your system for optimal speed.

Video Translation

With Close-Up, dissimilar PCs can easily connect, because Close-Up senses the video capabilities of both PCs and automatically displays Windows in a video mode compatible with both sides.

Risk-Free Offer!

Try Close-Up. If you're not absolutely convinced that Close-Up 5.0 is the fastest remote program, we'll give you your money back!* Order Close-Up Host & Remote, a complete system, for only \$199.*

Upgrade your current or competitive remote program to new Close-Up 5.0. Get both sides, Host & Remote, for only \$69.*

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Norton-Lambert



We invite you to reproduce this test. We used two identical Gateway 4DX2-66V's with 66-MHz Intel 486DX2-66 CPUs, 16 MB RAM, 256KB RAM cache, 340 MB HD, IDE controller, no hardware disk cache. Video: Local Bus ATI Ultra Pro with 2MB VRAM, 640 by 480 pixels, 16 colors, VGA.DRV dated 3/10/92. Monitor 72 Hz. MS-DOS 5.0, SMARTDRV 2 MB cache. Modems: two 14,400 baud V.32bis. WinBench 3.11 is available on ZiffNet accessible via CompuServe. Test performed without verification by Ziff. All products are shipping versions. WinBench trademark of Ziff Communications Co. Windows trademark of Microsoft Corp.

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CIRCLE 346 ON READER SERVICE CARD

GET A VIRTUAL VIRTUALLY E



Virtual screen technology is like having two monitors in one. Create the mother of all spreadsheets. Run PageMaker and Excel side-by-side. Use your monitor as a viewfinder and pan across to the place you want to be. All it takes to upgrade to a 2048 x 1024 virtual screen is just 2MB of optional RAM (1MB VRAM, 1MB DRAM).



Our chameleon cursor can change size and color so it never gets lost. So you never have to play that frustrating game of hide-and-seek.

SCREEN WITH EVERYTHING.

Our Resolution Exchange Panel gives you complete control over your desktop environment. And since the VL-Bus links video directly to your powerful 486DX2, your commands are executed instantly.*



*Resolution Exchange Panel and Hawkeye Zoom examples given for #9GXE configured with 3MB RAM (2MB VRAM, 1MB DRAM), and 1280 x 1024 monitor.

Our Hawkeye Zoom Feature gives you up to four levels of magnification.* So you can really see the details of what you're working on.

ORIGINAL SIZE



If you want to plug in a mouse, Dell gives you a dedicated mouse port.

If you open up your Dell Dimension™ XPS PC, inside you'll find a #9GXE video card. This fast and versatile video card uses the VL-Bus™ and ultra high-speed video RAM to give you the video ride of your life.

A Dell Dimension XPS PC configured with our #9GXE video card (with 1MB Video RAM) delivers 26 million WINMARKS! Or with our optional 2MB RAM upgrade (1MB VRAM, 1MB DRAM), it delivers a face-warping 33 million WINMARKS! Either way, we're talking incredibly fast.

But raw speed is just part of the Dell Dimension XPS story.

The Dell Dimension XPS's #9GXE video engine can be accessed on-screen via a control panel that allows you to configure a host of powerful utilities to give you total control of your desktop video environment.

Add our optional 2MB RAM upgrade and you have the power to switch your #9GXE to a virtual screen with a resolution of up to 2048 x 1024 pixels. Very cool.

This versatile add-in effectively gives you the desktop equivalent of two monitors. So you can have two full-size applications, like Excel and PageMaker, displayed side-by-side.

The virtual screen allows you to seamlessly pan across your monitor from application to application.

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Working against color backgrounds? Our chameleon cursor can change size and color so it never gets lost.

You can also create a whole library of time-saving "hot keys" for all of your applications.

When it comes to video and video-related utilities, Dell Dimension XPS PCs are your ticket to ride.

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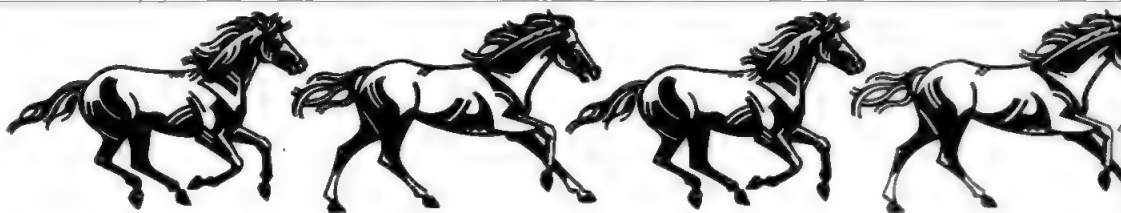
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FAST VS HALF-

DELL



OTHERS

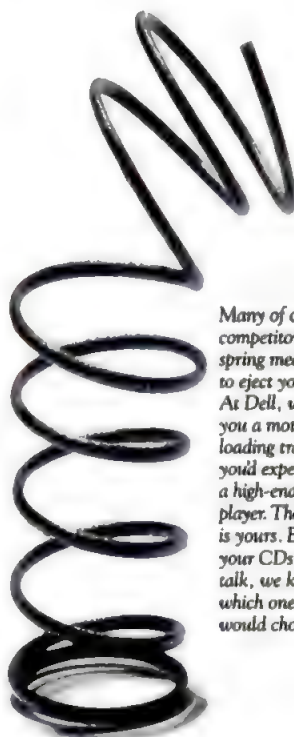


Bytes/Sec

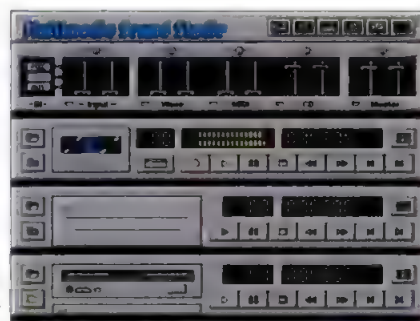
With faster access and nearly double the data transfer rate our double-spin CD ROM makes others seem positively sluggish.



Thanks to our multi-session CD technology, you can have the disk printed on up to four different times, storing up to 100 color photographs in all.

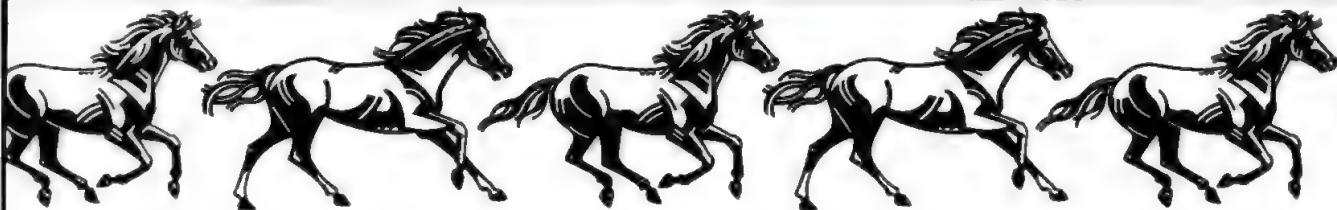


Many of our competitors use a spring mechanism to eject your disks. At Dell, we give you a motorized loading tray like you'd expect from a high-end CD player. The choice is yours. But if your CDs could talk, we know which one they would choose.



Whistle while you work. Or tap your foot. Or sing along. Our audio center CD ROM software lets you play disc jockey while you carry on with the important work of the day.

CDs FAST CDs.



153.6KB

300KB

When you buy a Dell Dimension™ XPS 450V or 466V equipped with a CD ROM, you get a CD ROM drive that runs circles around our competition.*

Thanks to advanced dual-spin technology, our CD ROM gives you an access time of just 350ms and a data transfer rate of 300KB per second. That's nearly twice the performance of many of our competitors.

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Our drive has the automatic, push-button motorized tray you'd expect to find on a high-end CD player.

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Our CD ROM is Kodak Photo-CD compatible. Which means you can take advantage of the latest in CD technology and view photographs on your PC screen.

What's more, our CD drive is multi-session. Which

means you can have the disk printed on up to four different times. Storing up to 100 pictures in all. Keeping them in perfect condition with no fading.

Our CD ROM also comes with software that lets you play your favorite audio CDs while you work.

So you can listen to Mozart as you crunch numbers or bop along to the Beatles as you cruise your local BBS.

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So if you want the best CD ROM technology for your money, make a fast decision and call Dell today.

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New & Improved

a selected part of a screen. 3D Studio 3.0 is also DPMI-compliant, so it will run under Windows as a DOS application.

• List price: *Autodesk 3D Studio, Release 3.0*, \$2,995; upgrade, \$497. *Autodesk Inc.*, 2320 Marinship Way, Sausalito, CA 94965; 800-879-4233, 415-332-2344; fax, 415-331-8093.
Circle 407 on reader service card

NEW

AST's New Line Includes Multimedia, Notebook Systems

Add the name Advantage! to the list of value-line PCs to remember. **AST Research's** new PC family includes desktop, minitower, multimedia, and notebook systems. The Advantage! Pro is a desktop PC with a 170MB hard disk, 4MB of RAM, local-bus video graphics with 1MB of video RAM, and four ISA expansion slots. It comes in four Intel 486-based models ranging from SX/25 to DX2/66. Also for the desktop, but in a minitower case, is the Advantage! Plus, with a 340MB hard disk, local-bus graphics with 2MB of video RAM, and six expansion slots.

The Advantage! Adventure multimedia systems come as a desktop or a minitower with 486SX/33 and 486DX2/66 processors, respectively. Each comes with a large hard disk (210MB and 340MB), a CD-ROM drive, local bus video graphics, a 16-bit sound card, a fax modem, and amplified stereo speakers. In a smaller form factor is the Advantage! Explorer notebook PC, which comes in monochrome, dual-scan color, and active-matrix color models with built-in trackballs and PCMCIA Type III slots.

• List price: *Advantage! Adventure*, \$1,999; *Advantage! Plus*, \$1,999; *Advantage! Pro*, \$1,199; *Advantage! Explorer*, \$1,899 to \$3,699. *AST Research Inc.*, 16215 Alton Pkwy., P.O. Box 57005, Irvine, CA 92619-7007; 800-876-4278, 714-727-4141; fax, 714-727-9355.
Circle 414 on reader service card

IMPROVED

Do Everything with Envelope Manager's DAZZle Software

Envelope Manager Software is shipping Version 2.0 of DAZZle, its comprehensive Windows-based envelope and label addressing program. DAZZle 2.0 prints graphics, messages, bar codes, and anything else you might want on your envelopes, and also supports Dynamic Data Exchange (DDE). Version 2.0 also comes with macros that let you verify addresses, look up ZIP codes, and print from within your

BRIEFS

PRINTERS AND PLOTTERS

of Japanese Kanji typefaces. I/O Software has developed Japanese TrueType-compatible PostScript drivers for Japanese Windows 3.1. The 8-ppm Kanji JetWriter comes with a RISC processor, 8MB of memory, 35 standard English PostScript fonts, and two Kanji fonts. 909-483-5706.

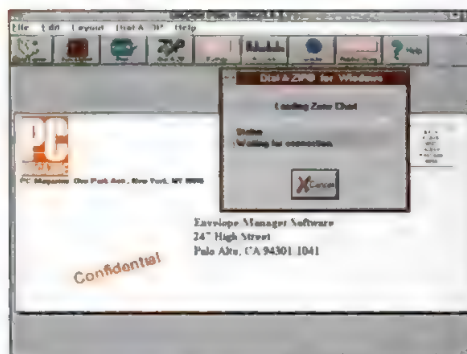
Mitsubishi International Corp. is adding a B-size dye sublimation color printer to its line of color printers. The ColorStream/DS Plus (\$21,000) is PostScript Level 2-compatible and comes with drivers for Adobe Photoshop. Driven by an AMD RISC processor, the ColorStream/DS Plus can print an image up to 11.7 by 17.09 inches. 415-496-5447.

Pacific Data Products has announced the ProTracer II (\$1,599) and ProTracer II-GL (\$2,149) personal CAD plotters. Both use an Intel RISC processor and a Canon ink jet engine to produce C-size drawings at 360 dpi. The ProTracer II has 512K of memory, emulation for Epson LQ-1050 and IBM ProPrinter XL24E printers, and drivers for AutoCAD releases 10 to 12. The ProTracer II-GL adds HPGL and HPGL/2 emulation and comes with 2MB of memory. 619-625-3663.

Not for everyone: **Xerox Corp.** has announced the Xerox 4890 HighLight Color Laser Printing System (\$232,500), a complete corporate printing solution for cranking out 300-dpi color pages at a whopping 92 pages per minute. Its base paper capacity is 1,500 sheets in weights from 20-pound office paper to 110-pound cover paper. It can be connected to large-to-midrange host computers, and it can accept data from PC, Macintosh, and Unix workstations. It comes with a 400MB hard disk for storing forms, fonts, logos, and other graphics. Call Xerox for much more information. 800-832-6979, ext. 903.

CD-ROMS

Aristo-Soft, publisher of the best-selling multimedia utility *Wired for Sound*, has put its know-how on CD-ROM. *CD-Blaster* (\$39.95) is a Windows desktop



DAZZle 2.0 checks ZIP codes on-line.

Windows word processor. Now you can print color fonts, multiple fonts in a single address, and rotated text. Envelope Manager has also introduced DAZZle Plus for printing, managing, and verifying addresses in a mailing list, and DAZZle Designer for creating Business Reply Mail.

• List price: *DAZZle, Version 2.0*, \$39.95; *DAZZle Plus, Version 2.0*, \$79.95; *DAZZle Designer, Version 2.0*, \$129.95. *Envelope Manager Software*, 247 High St., Palo Alto, CA 94301-1041; 800-576-3279, 415-321-2640; fax, 415-321-0356.
Circle 409 on reader service card

IMPROVED

Four New Versions of Borland's Paradox Are on the Way

Borland International's relational database management systems, Paradox for Windows and Paradox for DOS, are now in Version 4.5. The Windows incarnation now has customizable stylesheets so you control the look of your forms and reports, plus support for native FoxPro file formats, indexes, and memo fields. The new Paradox 4.5 for DOS has better mouse support, more flexible report printing, and refined file-management abilities, including the ability to browse file directories in dialog boxes. For developers, Paradox 4.5 for DOS has over 70 new Paradox Application Language (PAL) commands and a debugger.

Borland is also shipping the \$495 Paradox 4.5 for Windows Workgroup Edition, with Borland's Object Exchange technology for sharing information between users and between applications, and the \$695 Paradox 4.5 Development Edition for Windows, with SQL connectivity for developing client/server applications.

• List price: *Paradox Version 4.5 for Windows*, \$149.95; *Paradox Version 4.5 for DOS*, \$795. *Borland International Inc.*, 100 Borland Way, Scotts Valley, CA 95066; 800-331-0877, 408-431-1000; fax, 408-439-8088.
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New & Improved

NEW

Sigma Design's ReelMagic Will Play VideoCD Multimedia Disks

Sigma Designs has announced ReelMagic, a multimedia add-in card that plays full-screen, full-motion, full-color video and CD-quality stereo sound from a standard CD-ROM. Based on the Motion Picture Experts Group (MPEG) compression standard, ReelMagic will let you take advantage of the pending VideoCD standard, which gives multimedia PCs the ability to play movies or other videos from a CD-ROM drive. ReelMagic has its own processor on-board for decompressing MPEG files, which are often compressed at ratios as high as 200 to 1. The board comes with an installation program, a full set of drivers, and an MPEG game. VideoCD, which is backed by vendors like 3DO, JVC, Philips, and Sony, has gotten commitments from movie studios and VideoCD title should be available in time for Christmas.

• List price: *ReelMagic*, \$449. *Sigma Designs Inc.*, 47900 Bayside Pkwy., Fremont, CA 94538; 800-845-8086, 510-770-0100; fax, 510-770-2640. Circle 415 on reader service card

NEW

Colorado Memory Systems Enters DAT Tape Backup Market

The giant of the QIC tape backup market, **Colorado Memory Systems**, has entered the DAT tape drive market with its new PowerDAT Series 6000 Tape Backup System. Currently the vendor offers an internal and an external drive, each with a compressed data capacity of 4GB. The new PowerDAT drives have a data-transfer rate of 183K per second without data compression. Each comes with Colorado Backup for DOS, a Novell-compatible, full-featured software program that has mouse support and lets you schedule unattended backups.

The PowerDAT drives are the first to implement the new industry-standard Media Recognition System (MRS) for detecting sub-standard tapes and preventing you from storing data on bad media. They will, however, read non-MRS tapes, so you can access previously recorded information.

• List price: *PowerDAT Series 6000 Tape Backup System*, \$1,995 (internal); \$2,195 (external). *Colorado Memory Systems Inc.*, 800 S. Taft Ave., Loveland, CO 80537; 800-845-7905, 303-669-8000; fax, 303-667-0921.

Circle 408 on reader service card

BRIEFS

CD-ROMS

enhancement tool that packs over 2,000 sound effects, 300 MIDI music files, 400 talking icons, 100 designer cursors, 50 color cursors, and a video library of 200 photos and 150 video clips on one CD-ROM. Among the new utilities in CD Blaster is a Wallpaper Changer, a CD-browser, and a Juke Box for managing collages of multimedia elements. 800-338-2629.

Comprehend Technology has announced Comprehend Microsoft Excel Macros (\$249), a CD-ROM-based multimedia training system that teaches you how to write macros and custom applications in Excel 4.0. It runs concurrently with Excel, so as you go through a lesson you actually program real macros in Excel. The program features audio and animated video, which contribute to better comprehension. The lessons are organized so you can jump to the topic of your choice, and a series of control buttons lets you pause, stop, rewind, or forward the lessons. 212-286-8400.

Media Vision is publishing three new interactive CD-ROM titles: *The Forever Growing Garden* (\$49.95), a CD-ROM for young children that uses animation, music, and games to lead them through the process of growing a garden in real time; *Peak Performance* (\$59.95), an interactive CD-ROM game that combines video and trivia in a cross-country adventure; and *Critical Path* (\$79.95), an innovative CD-ROM that combines motion picture, video game, and computer-generated animation in a game where players interact with live-action human actors. 800-845-5870, 510-770-8600.

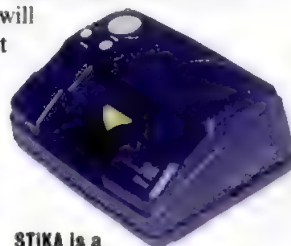
Multicom Publishing is shipping two new CD-ROMs, *Americans in Space* (\$69.95), an audio, video, and photographic history of America's manned space flights; and *National Parks of America* (\$69.95), an interactive tour through all 230 of America's national parks with information on camping and hiking, climate conditions, and other park information. *National Parks* is also endowed with over 970 photos by nature photographer David Muench. 206-622-5530.

NEW

With STiKA, What You Scan Is What You Stick

The **Roland Digital Group** has taken a small vinyl sign maker, combined it with a hand-held scanner, and put the two in a compact 3- by 8- by 6-inch portable unit called STiKA. When you plug the STiKA into the serial port of a PC and load the bundled SignMate Windows software, you're ready to scan in type, logos, or graphics and then transfer them to vinyl strips measuring up to 3 by 23 inches. STiKA also accommodates iron-on clothing transfers so you can create custom T-shirts and sweatshirts. The SignMate software will import and export

TIFF images as well as recognize TrueType and Adobe Type 1 fonts. If you want to make multicolored signs, SignMate has a color separation feature for cutting each



STiKA is a vinyl sign maker with a built-in hand-held scanner.

color layer of a sign separately. Roland sells transfer tape and many colors of vinyl, but both are also available through traditional suppliers.

• List price: *STiKA*, \$499. *Roland Digital Group*, 1961 McGaw Ave, Irvine, CA 92714; 714-975-0560; fax, 714-975-0569. Circle 413 on reader service card

NEW

PC-Kwik Takes on Dashboard With a WinMaster Utility

PC-Kwik Corp. has spun off the Windows application launcher from its WinMaster utility program and named it Toolbox for Windows. Toolbox is a floating button bar that can hold up to 50 buttons for Windows and DOS programs. As a program launcher and task switcher, Toolbox can effectively replace your Program Manager shell. You can also create and link multiple Toolboxes and call them up with hotkeys or from other toolboxes. Through November 30, 1993, you can purchase Toolbox for Windows directly from PC-Kwik for \$31.45 (including shipping and handling).

• List price: *PC-Kwik Toolbox for Windows*, \$49.95. *PC-Kwik Corp.*, 15100 SW Koll Pkwy., Beaverton, OR 97006-6026; 800-759-5945, 03-520-4295; fax, 503-646-8267. Circle 412 on reader service card

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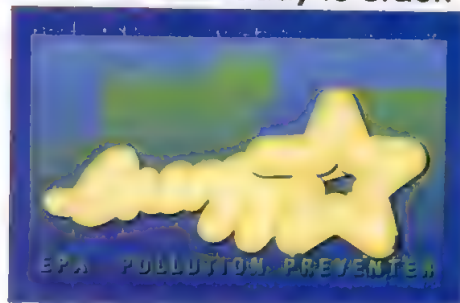


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REVIEWS OF THE LATEST BOOKS FOR THE PC USER

Edited by Lance Ulanoff

Cooking and Computing With Microsoft's DOS 6

BY BRENT HESLOP AND DAVID ANGELL

Microsoft's new DOS 6 upgrade has spawned a smorgasbord of new and newly revised DOS books. These guides range from lighter fare for beginners to full, ten-course meals for intermediate to advanced DOS users. We sampled over 70 DOS 6 books (so you wouldn't have to) and selected the cream of the crop.

Lighter Fare

The first edition of *DOS for Dummies* served up DOS essentials in a lively, humorous style that made it one of the best-selling DOS books of all time. Unfortunately, the second edition leaves its readers short-changed when it comes to DOS 6.

The Complete Idiot's Guide to DOS, on the other hand, is a copycat book that does cover the major new DOS 6 features that *DOS for Dummies* left out. These features include DoubleSpace (a hard disk compression utility), MemMaker (a memory management utility), DEFRAG (a disk defragmentation utility), and MSAV (a virus protection utility). Oddly, this guide doesn't cover important

DOS 6 laptop commands, INTR-LINK and POWER. While not written in the same sizzling style as *DOS for Dummies*, Jennifer Flynn delivers DOS 6 essentials in an easy-to-digest, lighthearted manner.

For those who don't find humor in MS-DOS, the no-nonsense tutorial approach found in *The First Book of MS-DOS 6* should suffice. This book is a big improvement over the DOS 5 version, which was written by a different author. Joe Kraynak rewrote the book from the bottom up. It now includes step-by-step instructions that clearly show how to accomplish most common DOS tasks using the DOS Shell or the command line.



Kraynak covers the new, key features of DOS 6, including DoubleSpace, MemMaker, and even the new laptop commands INTR-LINK and POWER.

Learn at First Sight MS-DOS 6.0

offers a visually appealing cartoon-based introduction to DOS for the PC-phobic. Here's a book that teaches DOS essentials, from changing the date to compressing a hard disk, without

bogging the reader down in technical details. The colorful, informative graphics greatly enhance the concepts behind the instructions for performing DOS commands.

• **The Complete Idiot's Guide to DOS**, by Jennifer Flynn, \$14.95. alpha books; 800-428-5331. ISBN: 1-878058-75-4.

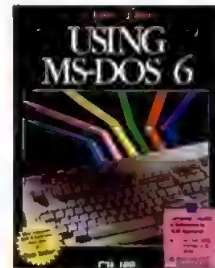
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• **The First Book of MS-DOS 6**, by Joe Kraynak, \$14.95. alpha books; 800-428-5331. ISBN: 1-56761-124-9.

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• **Learn at First Sight MS-DOS 6.0**, by maranGraphics, \$12.95. maranGraphics; 800-947-7700. ISBN: 0-13-064650-4.

Circle 491 on reader service card



suffers from sloppy copy editing of the new DOS 6 material and the information on the book's cover. For example, the back cover states that "Norton Utilities" is included on the accompanying disk. What you get is Morton Utilities, a shareware utility package.

Van Wolverton's clear explanations combined with his ability to anticipate the reader's questions make *Running MS-DOS*, 6th Edition, one of the friendliest DOS tutorials avail-

able. It provides hands-on coverage of DOS fundamentals for beginners and low-end intermediate users. An appendix of DOS commands cross-references the book's more detailed expla-

nations. Wolverton's solid prose is occasionally overshadowed by his proclivity for herding sometimes important DOS features out of the spotlight. For example, coverage of the DOS Shell, a useful, task-simplifying tool for learning DOS, is relegated to the back of the book. Missing from the otherwise detailed chapter on tailoring your system are DOS 6 multiple-configuration commands. Instead, they're skimmed over in the Command Reference.

Using MS-DOS 6, Special Edition, was written by seven knowledgeable authors. The result is an encyclopedic buffet of DOS topics that will satisfy most appetites. The book starts out with a hefty helping of over a hundred pages of DOS background information before actually telling the reader how to perform any practical DOS tasks. Just about every DOS topic is covered, from using the DOS Shell to working with

Full Meals

PC World DOS 6 Handbook, 2nd Edition, adds a twist to learning DOS by including a special edition of The Norton Commander. While not as powerful as The Norton Commander 4.0, the special edition is a better DOS shell than the one that comes with DOS. Using The Norton Commander as the DOS shell, the authors quickly get the reader performing essential, everyday DOS tasks. They then build the reader's DOS skills to a comfortable intermediate level. The book even covers how to use the supplementary Workgroup Connection program to connect a DOS system to a Windows for Workgroups network. A well-written A-to-Z command reference not only gives examples but explains when and why you would use each command.

On the downside, the book

Read Only Recommends

The Multilingual PC Directory, Second Edition, by Ian Tresman, is a one-of-a-kind, comprehensive guide to multilingual and foreign-language products for the PC. \$44.95, Knowledge Computing Ltd., 212-682-5844. ISBN: 1-873091-02-8.

Read Only

Workgroup Connection. The biggest problem with this book is that it suffers from a dry writing style that doesn't match up to the zest of the competition.

Mastering DOS 6, Special Edition, provides the most balanced coverage of how to use individual DOS commands and how to work with DOS as a whole. Informative and comprehensive, this guide is a good starting place for the uninitiated DOS user. In a straightforward style, Judd Robbins explains DOS concepts and commands with great attention to detail. The guide is filled with tips to help solve different system limitations. Robbins tackles such intermediate and advanced topics as setting up multiple configurations and QBASIC programming.

• **PC World DOS 6 Handbook, 2nd Edition**, by John Socha, Clint Hicks, and Devra Hall, \$34.95 (includes two 3.5-inch disks). IDG Books; 800-762-2974. ISBN: 1-878058-79-7.

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• **Running MS-DOS, 6th Edition**, by Van Wolvorton, \$24.95. Microsoft Press; 800-677-7377. ISBN: 1-55615-542-5.

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• **Using MS-DOS 6, Special Edition**, by Jonathan Kamin, Dave Angel, Eric Baatz, Doug Bierer, Matthew Harris, Robert King, and Mark Schulman, \$29.95. Que; 800-428-5331. ISBN: 1-56529-020-8.

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• **Mastering DOS 6, Special Edition**, by Judd Robbins, \$24.95. Sybex; 800-227-2346. ISBN: 0-7821-1236-6.

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Here's the Beef

Dan Gookin's *MS-DOS to the MAX* goes beyond the standard fare to help the reader exploit the new features of

DOS 6.0. This book is beefy yet accessible. Gookin jumps into working with DoubleSpace and MemMaker, explaining the potential for problems when working with these programs. He succinctly illustrates how compression works and how to work with compressed drives. Besides his clear explanations of complicated DOS topics, Gookin includes an annotated DOS file list that tells readers which files can be deleted to save disk space. The accompanying disk is the weak-

est part of this guide. It includes a sort of "hall of fame" of commands from earlier versions of DOS that were eliminated from DOS 6, and gimmicky AUTO-EXEC.BAT and CONFIG.SYS editors.

Inside MS-DOS 6 is a banquet of in-depth information on DOS 6.0 utilities. Written for the intermediate or advanced user, it's filled with information on disk drive technology, memory management, virus protection, and working with batch files. Sometimes unfriendly but always informative, this book also explains how to use third-party utilities, such as Stacker and QEMM-386, with DOS. The authors dig into DOS 6 subjects that most other books only brush over. For example, they not only

tell you how to use INTERLNK to connect two PCs, they also cover linking a PC to a Macintosh. The authors clearly explain the dangers of the new SMARTDRV disk-caching program. The pièce de résistance is an excellent chapter on using multiple configurations. The last chapter provides tips for using DOS with LANs (local area networks). This book also includes some shareware utility programs, many of which are improvements on existing DOS 6 commands.

• **MS-DOS to the MAX**, by Dan Gookin, \$29.95 (includes 3.5-inch disk). Microsoft Press; 800-677-7377. ISBN: 1-55615-548-4.

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• **Inside MS-DOS 6**, by Mark Minasi, Bill Camarda, David Stang, and Kris Ashton, \$39.95 (includes 5.25-inch disk). New Riders Publishing; 800-428-5331. ISBN: 1-56205-132-6.

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Dessert

What makes *DOS 6 Secrets* stand out is the author's real-world advice. Robert D. Ainsbury delves into a variety of DOS topics, such as using SMARTDRV and DoubleSpace drives; disk and memory management; batch file programming; juggling IRQs, DMAs, and device drivers; multiple configurations; and working with DEBUG. The book's opinionated, 200-plus-page DOS command reference provides practical examples, with a few tips

sprinkled throughout to carry the book's theme. The accompanying disks include an exceptional collection of DOS utilities, such as QEDIT, a fast, full-featured text editor; BATUTIL, which gives you increased flexibility for creating batch files; and SEEKASY, a powerful text-searching utility. Another 200-plus pages document the accompanying software.

DOS 6.0 Power Tools: Techniques, Tricks, and Utilities lacks the spice of its predecessor, written by Paul Somerson. However, the new version, by John

Goodman and John Socha, is still stuffed with helpful intermediate and advanced DOS techniques. It begins with a DOS overview that rushes into memory management and working with hexadecimal numbers, after which it moves at a more reasonable pace. As in the previous

edition, the text gives examples for a wide range of DOS topics, such as working with DOS device drivers and DEBUG. Over 300 pages are devoted to a DOS command reference and documenting the more than 100 new, helpful utility programs included on the bundled disks.

Budding programmers will find Jeff Prosis's updated *DOS 6 Techniques & Utilities* a rewarding read. Hundreds of pages are devoted to programming DOS utilities in assembly language, practical programming tips, and timesaving techniques. The utility programs explained in the text are included on an accompanying disk. Prosis proves that covering a complex topic such as assembly language programming doesn't have to put you to sleep; the writing is not just informative but clear and fast-moving. The topics range from configuring and optimizing your system to writing TSRs and device drivers.

Although the inclusion of DOS 6 features in this new revision is almost seamless, the book's overall organization is sometimes confusing. For example, Prosis introduces DOS Shell tips after

a chapter on writing device drivers, and he covers batch files after a brief introduction to assembly language. □

• **DOS 6 Secrets**, by Robert D. Ainsbury, \$39.95 (includes two 3.5-inch disks). IDG Books; 800-947-7700. ISBN: 1-878058-70-3.

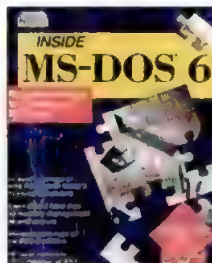
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• **DOS 6.0 Power Tools: Techniques, Tricks, and Utilities**, by John Goodman and John Socha, \$39.95 (includes two 5.25-inch disks). Bantam Computer Books; 800-733-3000. ISBN: 0-679-79138-8.

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• **DOS 6 Techniques & Utilities**, by Jeff Prosis, \$39.95 (includes 3.5-inch disk). Ziff-Davis Press; 800-688-0448. ISBN: 1-56276-095-5.

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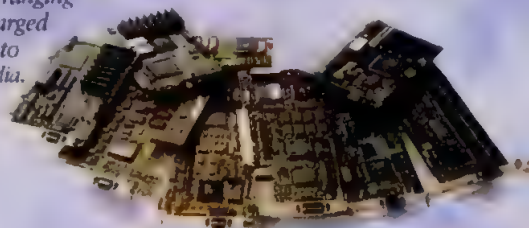


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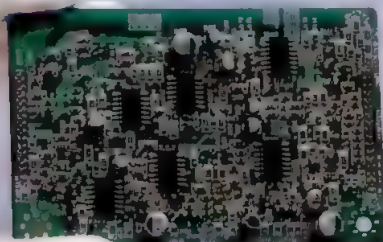
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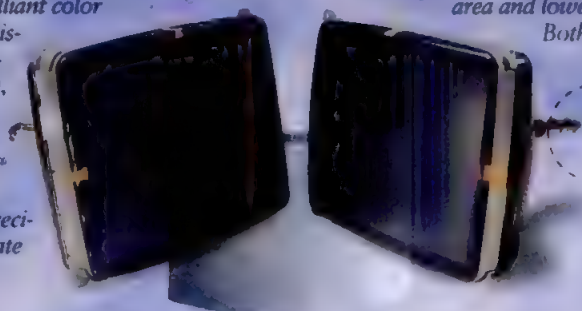
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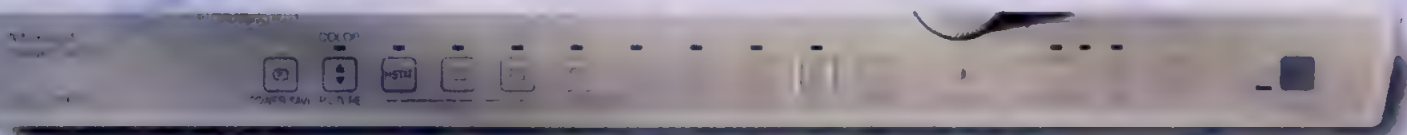
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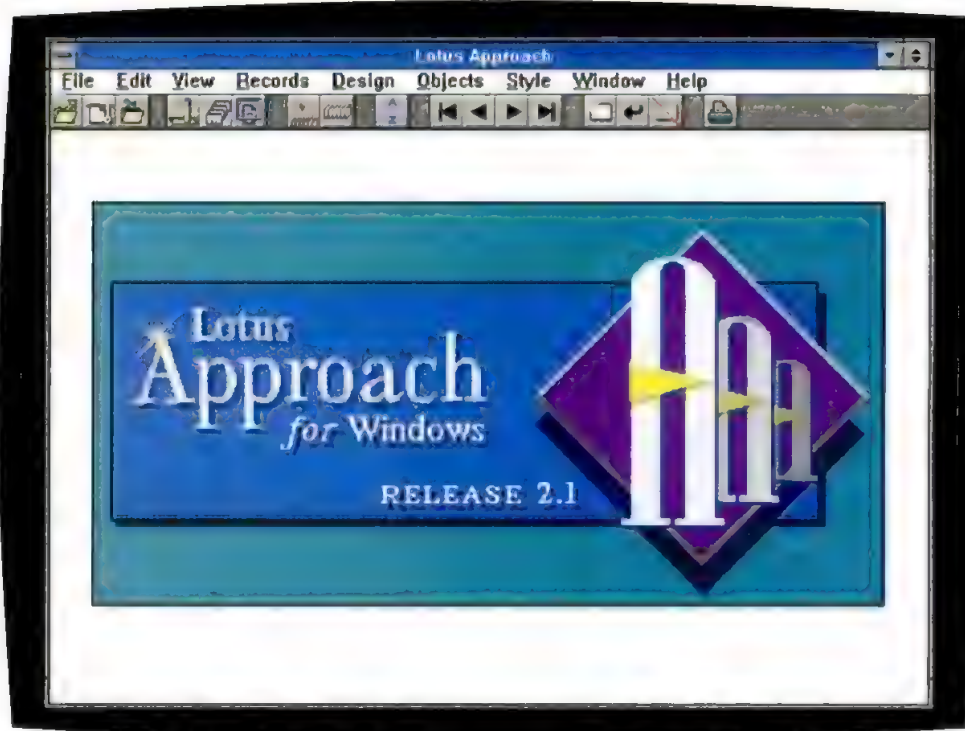
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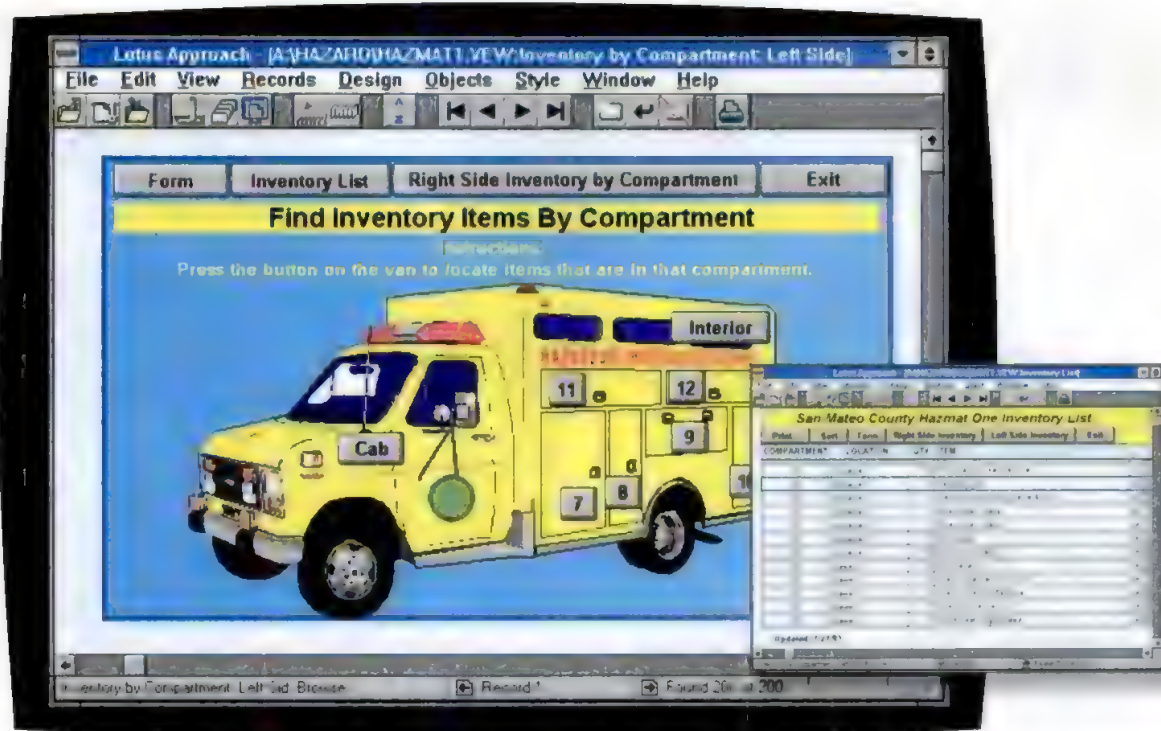
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Create a Great First Impression with wInstall

BY J.W. OLSEN

If you rely on DOS batch files to install products, you're inviting needless support calls because these files have limited error protection and an inability to detect available resources. They also make a poor first impression. And installing Windows programs introduces a whole new level of complexity.

You could write your own installation program, but an easier approach is to use one of the script-driven installation toolkits on the market. Knowledge Dynamics Corp., makers of a popular script-driven installation toolkit for DOS, has recently introduced wInstall, Version 3.2 (\$399.95), a DOS and Windows installation toolkit. A script-compatible OS/2 version is also available. With wInstall, your Windows installation programs will be bulletproof and will look professional.

DOS AND WINDOWS IN ONE EXE

A novel wInstall attraction is its flexibility in running from Windows or DOS. This is accomplished through creative use of the DOS stub that every Windows program contains—the part that delivers the message “This program requires Microsoft Windows” when you try to run it from a DOS prompt.

By using the DOS stub, wInstall can be configured to locate and launch Windows and then launch itself when the installation is run from the DOS prompt. Other provided stubs let you instead run the DOS

version of the installer or display the traditional “requires Windows” message.

Precompiled versions of the Windows installers come with the package. Depending on the option you choose, the size can vary from 249K to 430K—rather hefty for small projects. (The DOS-only installer is 100K.) wInstall also ships with full source code so you can make modifications to meet special needs. To make the build easier, there is a MAKE file and a proprietary MAKE.EXE that works with both the Borland and Microsoft C compilers. Installer distribution is royalty-free.

To create an installation program, write a script file called INSTALL.DAT. The installer reads this file; all versions of the installer look for a file with this name. Your distribution disks will always contain three files: a version of the installer renamed INSTALL.EXE, a script file called INSTALL.DAT, and a disk-identifying file named DISK.ID.

wInstall's nearly 200 script-language functions offer a vast array of sophisticated features. For example, you can analyze a user's system and write branching logic based on the configuration. Your script can even create or modify AUTOEXEC.BAT, CONFIG.SYS, Windows .INI files, and Program Manager groups, and it can reboot Windows to activate

.INI file changes. Extensively annotated sample scripts help make the learning process for this language easier.

wInstall does not use VER.DLL to check the version of DLLs or other Windows modules. But, script-language functions let you check the file's date, time, and size, and CRC checking can alert you to file differences. wInstall also lets you selectively install components of an application.

In addition to the scripting capabilities, wInstall includes a variety of ancillary utilities. These let you split large files across multiple disks, compress and decompress distribution files, and test for file validity using CRC checking.

You can create distribution disks manually, using the utilities provided, or you can use the DDB (Distribution Disk Builder) utility. DDB lets you select files to distribute, formats the target disk, creates the necessary DISK.ID file and a rudimentary INSTALL.DAT, compresses the files to be distributed, and splits files across multiple disks if necessary.

SLOW VERSUS BIG

Large as the installer executables are, they are about 100K smaller than they would be had not the p-code option of the Microsoft compiler been used to create the product. A partially parsed version of the code, p-code, must be interpreted at runtime and reduces executable size at the expense of speed. As a result, installer execution is quite slow. If you don't like this trade-off, you can recompile the source code with-

out p-code and realize performance gains of 30 to 50 percent. Alternately, you can wait for Version 3.3, which is slated for release in November. Version 3.3 will do away with p-code, yet it will still slice installer size in half by means of a technique for compressing Windows executables.

To improve performance, wInstall uses a tight message loop, only infrequently releasing control to Windows. This can all but disable background tasks and means that your users may encounter difficulties using wInstall with a screen saver.

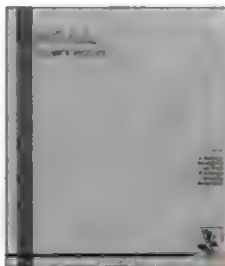
In addition to its sluggish performance, our tests uncovered a few other problems. wInstall improperly attempts to search your CD-ROM drive when scanning for WIN.COM. There is also a problem with multidisk installations under Windows when SHARE is loaded: The installation program will not be able to read Disk 2. Knowledge Dynamics is aware of both these problems and says they will be fixed in the next release.

wInstall requires a lot of disk space, and this first release suffers from some minor glitches. But its royalty-free license, powerful scripting language, and distribution of source code can be important advantages for large applications that have complex installation requirements. □

• wInstall, Version 3.2

List price: \$399.95. Requires: *Windows 3.0 or higher, 5MB hard disk space; a C compiler is necessary for optional modification of source code. Knowledge Dynamics Corp., P.O. Box 780068, San Antonio, TX 78278; 800-331-2783, 210-979-9424; fax, 210-979-9004.*

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Michael J. Miller

In Search of Great Communications

Exactly a year ago, I wrote a column called "Communications Software Stinks!" In it, I complained that, while electronic mail is a wonderful, useful innovation, the communications packages we use to access and manage e-mail range from mediocre to

terrible. In the past year, I've seen lots of new programs in this field, but communications software *still* stinks.

That's not to say that we haven't seen any improvements; there've been more than a few. But in the end, they all earn a collective "close, but no cigar."

Consider what I've gone through looking for a new front end for MCI Mail, the service I use most to communicate electronically with the outside world.

LONG IN THE TOOTH

I started this year using good old Lotus Express. By then, Express had long since passed the regal graying of middle age and was fast entering dotage. Along with significant limits on the number of messages you can put in each folder, Express 1.x is based on what may be the largest memory-resident program ever written. (A 220K TSR?!)

Earlier this year, MCI (which acquired the program) finally released an upgrade, MCI Express 2. At first glance, it's a significant improvement. Though still DOS-based, Express 2 has a much more modern menu system (with pull-down menus and mouseability). MCI removed the limits on the number of messages per folder and added the ability to put folders within folders, along with better logic for when Express automatically polls for messages. MCI also built in an address book, and even added a spelling checker. All of these changes and additions spelled "big improvement," and I used the program for several months.

Yet soon I discovered Express 2's dark side. If an incoming message was wider than my screen, I had to wrap the text manually. Other programs do that automatically. More troubling, I would often run out of memory because I had too many messages in a folder. Even worse, every so often, the program would

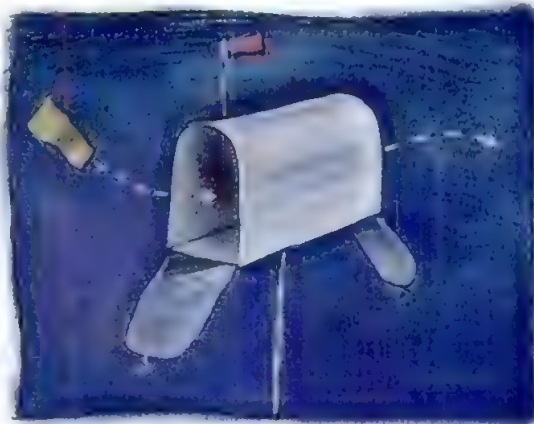
get extremely mixed up, and I'd end up using its Recover utility to find all the messages it had lost. Even then, those messages would end up in special recovery folders, and moving the messages back into the proper folders was a pain. Finally, I gave up on Express and started looking for an alternative.

NEXT!

When I first saw Swfte's The Wire, I had high hopes for this Windows-based MCI front end. It has a very attractive user interface, a built-in address book, and none of Express 1.x's limitations. The problem: Lots of folks on our staff had already tried the product with mixed success, resulting in complaints ranging from lost attachments to lost messages. An update promised some relief. Yet it's still slow and requires that users load SHARE first.

Instead, at a coworker's recommendation, I moved to Mailroom, a shareware product from Sierra Solutions. Mailroom takes a minimalist approach. It's also a Windows-based MCI front end with fairly simple menus and features, but it works pretty well. It wraps incoming messages properly and accepts an unlimited number of messages in folders. There are, however,

some bothersome limitations. It will automatically poll a maximum of only four times a day. Considering the kind of mail traffic I get, that's a major limitation. You can move a message from one folder to another, but you can't copy the message. And there's no provision whatsoever for searching out messages in your folders. (Since Mailroom stores messages as ASCII files, you could find another program that would do this, but that's a pain.) In the end, it worked *okay* for me, but it just didn't really do everything I wanted.



*We're getting tired of waiting
for the "killer" communications
e-mail application.*

Michael J. Miller

CONTESTANT NUMBER 4

Next, I tried Connect Software's E-Mail Connection. On the surface, this product looked very close to ideal. It supports multiple sources of electronic mail in a single in-box, including MCI, CompuServe, Microsoft's MAPI, and Novell's MHS. It has a nifty-looking Windows-based user interface, complete with a toolbar.

So what's the problem? It turns out that there are several. The first version's user interface, though pretty, is also crowded—particularly on a 640-by-480 screen. Also, E-Mail Connection constantly asks you to confirm things, packed message folders tend to slow it down, and it doesn't work well in the background. The product's 2,400-bps connection limitation, however, was the most frustrating. Connect promises to address some of these shortcomings in a soon-to-be-released upgrade.

Okay, so these MCI Mail front ends aren't working out so well. Why don't I just give up and have my MCI messages for-

warded to an internal message system such as cc:Mail, which we use internally at *PC Magazine*? This, too, sounds good, and we even tried it. Unfortunately, the gateway still isn't very good, limiting both the number of single-message addressees and the size of messages that can go through the gateway.

Besides, even though Lotus Development Corp. released a nice new cc:Mail client this year, the remote version is prehistoric. It is stuck with an awkward character-based interface, can't work in the background, and doesn't even recognize cc:Mail's own bulletin boards.

How about Lotus Notes, which many other people at Ziff-Davis Publishing Co. use? It's fine if *everyone* uses it. But the e-mail portion still seems awkward to me, and the gateways suffer the same problems as in cc:Mail.

HODGE-PODGE SOLUTION

And so here I sit, saddled with multiple communications programs, none of which make me particularly happy. I use Notes for some corporate communications, tapping into its great forms-routing, discussion-database, and information-gathering features. I use cc:Mail for internal e-mail, and MCI—and

what seems like a never-ending succession of front ends—for external e-mail. I still use OzCis for CompuServe, because it handles threads so well. And I use general communications software, such as ProComm, Crosstalk, or Microphone, when I dial bulletin boards.

So that's what I use today. Here's what I want: a program that can connect to all of the popular public services, *plus* the major LAN-based e-mail services, such as cc:Mail, Notes, Microsoft Mail, MHS, and WordPerfect Office; one that keeps a single in-box, with intelligent searching and sorting features; one with an intelligent address book that manages connections so you can easily send out or reply to messages among people on multiple services; and one that can automatically poll your e-mail services at whatever interval you want—perhaps even one that understands threads on a service such as CompuServe. It would be even better if it would manage communications and figure out the most efficient way to send messages, whether by LAN, telephone, or even, in the future, wireless communications.

All of this sounds like a lot, but I'm sure that *someday* I'll find such a program. E-mail me if you find it first. . . MCI ID: 247-8102.□

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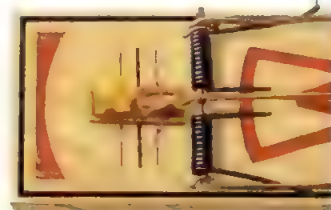
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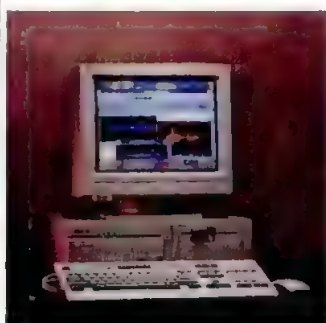


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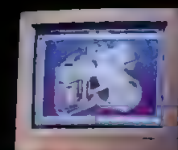
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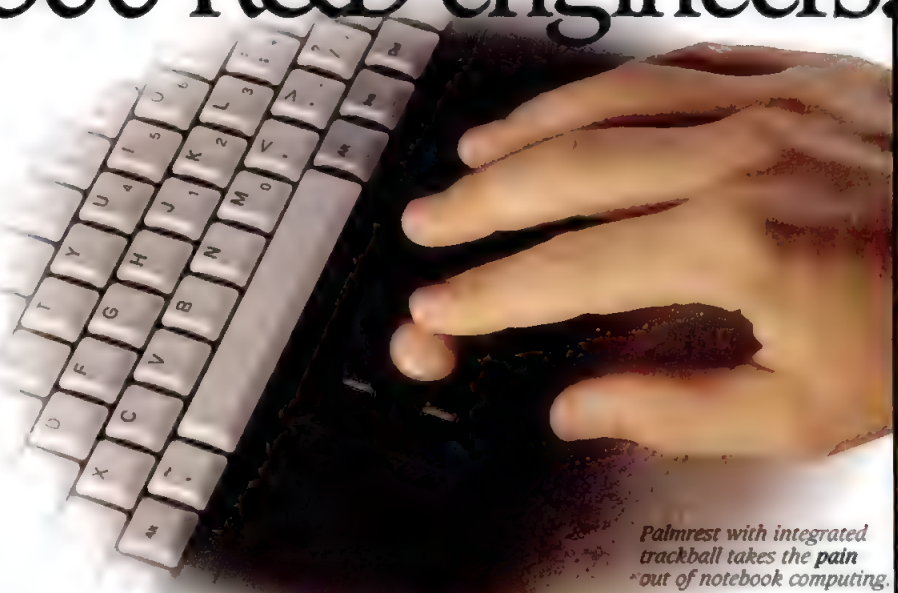
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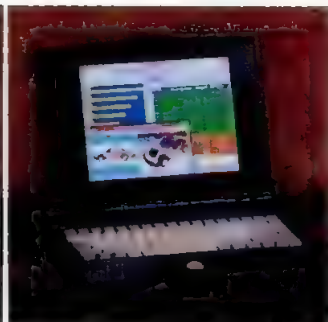
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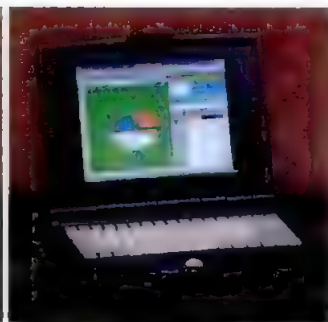


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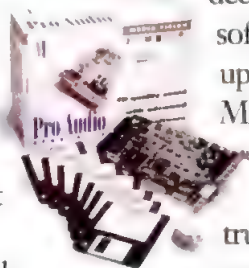
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Bill Machrone

Trade Show Travails

It's hip and insiderish for journalists to complain about trade shows. We go to more of them than anyone but exhibition department reps at hardware and software companies. We carp about the long lines, the boring press conferences, the frozen

shrimp, and the roving bands of media relations people forcing their press kits on us. We grouse about our tired feet, the miles of aisles, the jostling crowds, the jammed airplanes, and the days and nights of meetings. We shake our heads disbelievingly at the stupid hats, the sprawling booths, and the barkers who whip their audiences of sober, responsible, IS managers into enough of a frenzy to scream, "Word Perfect Executive Office!" at the top of their lungs.

These things don't faze me. The blatant commercialism, the hucksterism, and the carnival atmosphere are as American as apple pie. We're there to be sold, and sold we will be. When we're invited to vendor parties, it's not because we're such great guys and they love our company. They fervently hope that we'll write about their products and that you'll buy them. Any other outcome would be a waste of money. Also, for those three or four days, we're in product heaven. Every technology and some of the most knowledgeable people anywhere are just steps away. If you don't avail yourself of these riches, you have no one but yourself to blame. So I'll be there, but I still have a complaint—three of them in fact.

SOOR KEYNOTE

I'm bothered most by the abuse of a ritual form, the keynote speech. The traditional purpose of a keynote speech is to set the tone for the show; to put the technology, the economic climate, and the business objectives into perspective; to analyze the variables under which we're working; and to offer insights that will help us make good decisions in the coming months. We don't get too much of that anymore. Instead, we get a sales pitch.

The keynote speakers are the captains of our

industry, and rightly so. For who knows the immediate future better than the people who are inventing it? Somewhere along the line, however, something went wrong. The glimpse into the future became a product demo, a big press conference. The marketing and PR cynics will doubtless say that the opportunity to speak to thousands of potential customers is too good to miss.

The keynote speech has become a political football, too. Most of the show schedules have been gerrymandered to provide multiple keynotes. Spring Comdex, for example, is split into two shows: Comdex and Windows World. Since Microsoft sponsors Windows World, it has paid for the privilege of having Bill Gates as the keynote speaker. (Oftentimes the Comdex keynoter is chosen to counter Microsoft's power and influence.) Bill has been the keynote speaker at Fall Comdex more than anyone else and has given some memorable presentations. For example, the larger concept of Information at your Fingertips first saw the light of day as a Comdex keynote. It doesn't bother me in the slightest that a company as influential as Microsoft presents its view of the future in terms of its own products—that's to be expected. I'm pushed over the edge, however, when the keynote is the

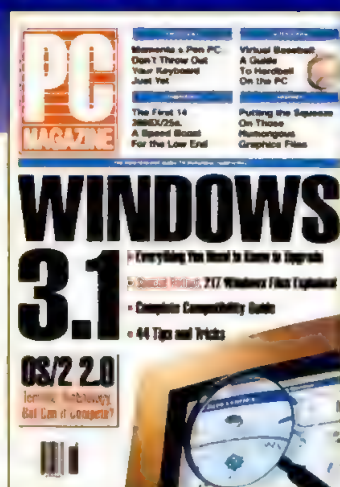
formal announcement and demonstration of Windows NT, as was the case at Windows World this past Spring. Never mind that NT was still flawed and wouldn't ship for months afterward. The opportunity to speak to thousands of potential customers was just too good to miss.

Bill Gates is a phenomenal drawing card. Even if you set aside the public's interest in his influence and wealth, he's still one of the smartest people you'll ever meet, which makes his speeches interesting, even challenging. So when he stands there and gives a



*Why does sound
business judgment fly out the
window at trade shows?*

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Bill Machrone

product demo that could as well be done by one of his junior product managers, I feel cheated. Maybe it's the best thing for Microsoft, but then let's not gussy it up in the trappings of a keynote speech.

SEXISM AND VIOLENCE

Every trade show has a surfeit of young women in the booths, doing the thankless and unrewarding job of collecting lead forms and business cards. Most of them have been hired for the occasion from modeling agencies for their looks, not their clerical abilities. Are we to assume that the male showgoers will be so taken by their beauty that they'll stop dead in their tracks and enter the booth? Will they spend additional time in the vendors' booths and inadvertently learn more about the product while hoping against hope for some morsel of attention? What does the vendors' insistence on attractive young women with no knowledge of the company or the product say to the burgeoning ranks of professional women in our industry? It gets infinitely worse when the vendors have the models dress in skimpy attire.

These vendors perpetuate a number of unhealthy scenarios that discount the intelligence and accomplishment of women by making them iconic objects of desire. I suggest that any marketing director who wants to be surrounded with youth and beauty ought to hire men and women in equal measure.

And why is it that virtually every vendor with a video display product uses violent images to showcase its capabilities? I've seen enough *Top Gun* and *Terminator 2* footage to last me a lifetime. I enjoy action films in their context, as entertainment. But they have nothing to do with stressing or testing the qualities of the display, nor are they in any way business-related. A few vendors are so witless that they use these movies as sheer attention-getters. They don't even have video products in their booths. You're supposed to stand there and gawk as a salesperson tries to interest you in a line of antistatic bags and screen wipes. Spare us.

Trade shows are unique opportunities. They're work. They're fun. But they're not a frat party. Exhibitors and attendees alike can't suspend the rules of sound business practice for a few days of self-indulgence. □

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John Dvorak, *PC Magazine*, March 30, 1993

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Jerry Pournelle, *Byte*, April 1993

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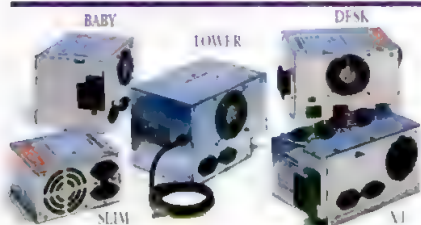
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Upgrade your computer with one of our premium **Turbo-Cool** power supplies—the choice of PC professionals. You'll get 50% - 100% more power, built-in line conditioning, super-tight regulation, ultra-clean output, a high-capacity **ThermaSense** variable-speed fan (300W models), UL/CSA/TUV approvals, and a no-hassle 2-year warranty! Ideal for high-end workstations and network file servers.

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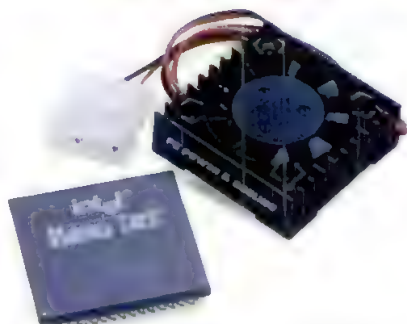
	Desktop	Tower	Monster
Exposed Drive Bays:	3	6	13
Total Drive Bays:	5	8	18
Motherboard Capacity:	1	1	2
Power Supply Capacity:	1	1	2
Cooling Fan Capacity:	2	3	6
Filtered Air Inlet:	Yes	Yes	Yes
Lockable Front Door:	Yes	No	Yes
Professional Controls:	Yes	Yes	Yes
All-Steel Construction:	Yes	Yes	Yes
Beige or Black Finish:	Yes	Yes	Yes
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It's a fact. 486 chips run hot, often exceeding 185°F! Now, you can cool your 486 to a safe 85°-95°F with our popular **CPU-Cool**. It prevents random system errors and other heat-related problems. Consists of a mini-fan embedded in a sculptured heat sink that easily mounts on the CPU. Powered by a spare drive connector. Effective, inexpensive insurance!

■ cools CPU 70° - 100°F

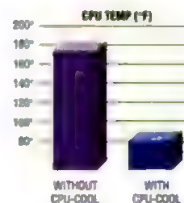
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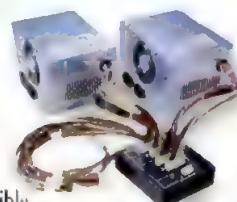
■ load-sharing design

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■ allows dual UPSs

■ monster-case compatible

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PC Magazine, Cover Story, Portable PCs, August, 1993

Presenting an amazing deal on the IBM PS/Note™. We've teamed the quality and reliability from IBM® with added features and a price breakthrough that only Micro Electronics™ can deliver.

Small and lightweight, the PS/Note operates with the Intel 486 SL processor and has the power to run demanding business software. A larger, 170MB hard drive, 4MB RAM, included fax modem and added PCMCIA capabilities give you the features you want—all at a special price. Plus, the PS/Note comes loaded with popular software and bundled extras!

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The advanced power management hardware and software give you a longer battery life. With power management enabled, you can run the monochrome PS/Note for up to five hours with the NiMH 2200 MA batteries. And there's no memory effect.

The IBM PS/Note

A larger 170MB hard drive and built-in fax modem included! Plus:

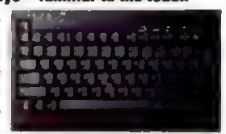
- an Intel 486 SL/25MHz processor
- 4MB RAM (expandable up to 20MB RAM)
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- a built-in 1.44MB 3.5" floppy drive
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The PS/Note features an exceptional, full-size 85-key keyboard with the unique TrackPoint II pointing device. Control cursor movements with ease by moving and varying pressure on the eraser-like button.



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Monochrome \$2199
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• 486 SL/25MHz
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- One-year limited warranty with toll-free Express Maintenance
- 30-day unconditional money back guarantee
- On-line technical support for the life of the computer.

Specifications

Size/Weight
 • 11.7" X 8.3" X 1.9"
 • Monochrome: 5.2 lbs with battery
 • Color: 5.6 lbs with battery

Pointing Device

• TrackPoint II

Battery

• Monochrome: up to 5 hours with power management

- Color: up to 3 hours with power management
- NiMH (no memory effect)
- 2.2 Amp-hours
- T10 AC Adapter
- Quick 1-hour recharge when not in use

Advanced Power Management

- Power management hardware and software (nearly transparent to user) for longer battery life

- Automatic and manual suspend/resume button
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- Intel 486 SL 25MHz CPU
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Drives

- One built-in 1.44MB 3.5"

- floppy drive
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- Comes with MS-DOS 6.0, Microsoft Windows 3.1, Microsoft Works for Windows, PRODIGY America On-line (PS/1 Edition), PS/1 Tutorial, PS/1 index, PS/1 Fitness, and choice of Quicken, WinFax Lite or Calendar Creator Plus

Display

- 1024 x 768 for external monitor with 512k video RAM
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- Color: 256 colorscale 9.5" STN color
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- Full-function keyboard with 85

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Best Notebook Values.



"Scoring high in overall value and design, the Micro Electronic's WinBook gives you a lot for your money, including an outstanding integral trackball."

PC MAGAZINE, Portable Computing Issue, August, 1993

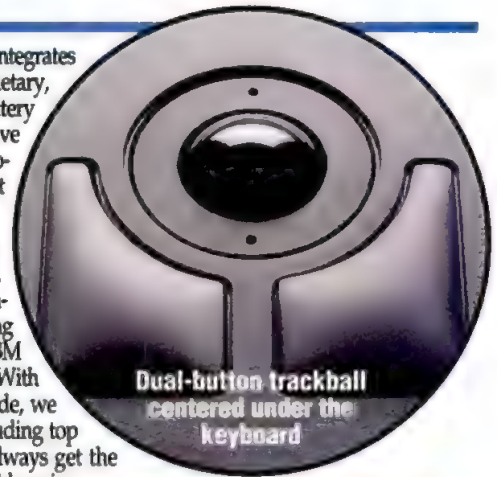
The WinBook by Micro Electronics™ gives you the power to run Windows and a unique, ergonomic design to make it easier to use.

It features a built-in, centered trackball which allows you to control cursor movements effortlessly without having to lift a single finger off the keyboard. Full-size keys and a sloping hand rest let you work in total comfort.

The new, upgradable, fully-static design SL enhanced Intel486SX 25MHz chip enables the CPU to operate at a 0MHz low power state. The

WinBook's Pico Power Evergreen chipset integrates battery and power management with a proprietary, open loop heat regulator circuit to extend battery life and prevent heat build-up. Plus, we have fine-tuned the WinBook's screen. In monochrome and in dual-scan STN color—you get sharper, clearer images with less cursor loss.

The WinBook was engineered for Micro Electronics, a division of MEI/Micro Center, Inc. MEI is America's leading direct source for computer products. Micro Center has been selling PCs for more than 14 years—longer than IBM or Compaq—with over 736,000 units sold. With over 2.2 million satisfied customers nationwide, we have developed a superior support staff including top engineers and technical specialists. So you always get the highest quality product at the lowest possible price.



Dual-button trackball centered under the keyboard

WinBook™



WinBook 486 SX Features



Ergonomically engineered

The WinBook's ergonomic features include a sloping hand rest and keyboard, plus a centered dual-button trackball—allowing you to work in total comfort away from your desk.

Clean, sharp color display

The WinBook's advanced, dual-scan color display gives you 99% shadow-free performance compared to other single-scan passive matrix displays. You get near active matrix quality at a passive matrix price!

The 5.4 lb. WinBook, designed by award-winning Palo Alto Design

- Includes a 9600 baud send 4800 baud receive fax/2400 baud modem.
- Fast-acting, LCD screen for less cursor loss.
- Industry-standard PCMCIA 2.0 slot for future expandability.
- 512k video RAM.

Mouse/keyboard, parallel, serial & VGA ports plus PCMCIA expansion



Docking station gives you desktop power

With the available docking station, your WinBook instantly becomes a full-function desktop computer. The two expansion slots and drive bays allow you to add peripherals such as monitors, hard drives, CD ROMs, I/O cards or an extended keyboard. It also includes parallel, serial, PS/2 mouse, external keyboard and VGA ports. And it's just \$399!

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The WinBook features NiMH 2200 MA batteries with gold-plated contacts. This allows it to run much longer than units with traditional NiCAD batteries—and there's no memory effect.



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Monochrome	Dual-Scan Color
\$1699	\$2399
4MB RAM 120MB HDD	4MB RAM 200MB HDD
• Intel 486 SX 25MHz	• DOS & Windows
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Specifications

- Size/Weight**
 - 11" x 6 3/4" x 1 3/4"
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- Painting Device**
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 - Microsoft-compatible trackball
- Battery**
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- management** over 5 hours with auxiliary battery (less 30 minutes for color)
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- Microsoft Windows 3.1
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ColorNote 486: \$2995

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- 170MB IDE hard drive
- Custom leather carrying case
- MS-DOS 6
- Microsoft Windows 3.1
- Lotus Organizer

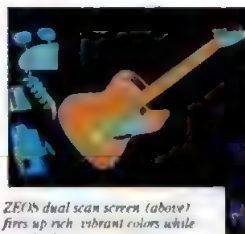


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ZEOS dual scan screen (above) fires up rich, vibrant colors while standard passive matrix screen (right) produces faded and dull colors. Photos are not retouched.

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CIRCLE 038 ON READER SERVICE CARD



John C. Dvorak

Coming to a CD-ROM Near You

The latest doomed-to-fail idea dreamed up by the loopy marketers is the CD-ROM loaded with locked software. Running a close second is the hard disk preinstalled with a slew of locked software. This has an immediate appeal to the bug-eyed

vendors who think this is opening a new channel of distribution. In fact, it's doing nothing of the sort, and the scheme will actually hurt sales.

The concept is simple: You fill a CD-ROM with a load of applications plus a special program to demo them. The buyer gets the CD-ROM for some ridiculously low price like \$9 and plays with all the demos. The buyer is so enamored that he calls an 800 number and spends \$400 to get a code, which releases the full-blown mega-package. He installs it on his hard disk and prints the documentation. Gee, cool, huh?

Here are the problems.

1. If a CD-ROM has 50 software packages, how many will actually be the versions currently shipping? Is the vendor going to update the entire disk every time a new version of any single program is released? Unlikely.

2. Who's going to sell the release codes to unlock the programs? Will it be the software companies, which would dearly want the mailing list of users? If it's the software company, it would have to sell the software at list price, not at the "street price," wouldn't it? And if it is the software company, then why would a store carry the CD-ROM? Where's the profit at \$9? Diverting potential retail sales to software companies' direct sales departments is ludicrous. If it's the stores that give out the code, then where is the accountability needed by the software company? A dealer could sell codes up the wazoo without ever sending a nickel to the software vendor. Or the dealer could send a pittance to the software vendor to account for the few users who actually register the program. This looks pretty bleak as a new marketing idea.

3. Where is the merchant

dising aspect to all this? I'm reminded of the never-ending crackpot schemes to create an electronic distribution channel for commercial software. You set up a kiosk. The buyer pushes a button. A modem downloads a copy of Lotus 1-2-3 for Windows onto a floppy disk. The buyer walks away feeling gypped. There's no bound documentation or fancy box with all the special offers. People like merchandising. They prefer the big boxes and pretty designs and nice bound documentation. If they didn't, then software would still be sold in plastic bags just as it was in 1977.

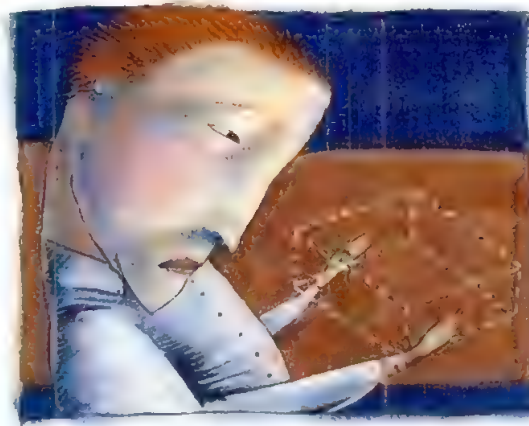
4. And what about perceived value? How does someone feel after pushing a button and getting a couple of unboxed disks for \$200? Unfulfilled, that's how. If I coughed up \$200 (or more) and got nothing more than a code for a CD-ROM and never actually received a product, I'd be inclined to think that software was overpriced.

One way to get around all this, of course, is for the software companies to make it clear to the buyer that he'll receive the complete package and documentation by mail once he registers. This will help audit the store releasing the code. The code, of course, has to be calculated

from a checksum or some other mathematical aspect of the CD-ROM. Therefore, this has to be a calculated value that could effortlessly be cracked, opening the whole disk to everyone.

5. Finally, why would a store sell a disk that discourages people from returning to the store? Doesn't anyone know the basics of retailing?

CD-ROMs should be promoted as an easy way to install software, not as a gimmick to sell software. As for the hard disks full of locked software—can you spell ERASE *.*?



*CD-ROM software distribution
is bad for retailing, bad for software
developers, bad for customers.*

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Inside Track

T

hese Guys Aren't About to Quit Dept.: DEC is still **pumping** up the volume with a new 166-MHz Alpha AXP chip engineered for Windows NT PCs. It's called the 21066. This chip has a built-in PCI interface, a controller, and an on-chip

graphics accelerator with a Graphics Winmark score of 30 megapixels per second. Combine this with an integrated phase-locked loop clock and you have the makings of a nice piece of equipment, especially since DEC intends to sell this for **half the price** of the Pentium. It may even be cheaper than some 486 chips, since it's priced at less than \$400. Let's see what the company does with this tiger. Time is running out for the Alpha if the public doesn't get jazzed on it. This is now a function of DEC marketing. (There's an **oxymoron** in there someplace—you can write your own jokes!) The company itself says that a hot Alpha-based PC will cost less than \$3,000. Holy Moly!

Meanwhile, DEC is working on three systems using this chip. Also look for a **supersecret Alpha-based laptop** to hit the market. It's based on the 21068—a 66-MHz version of the 21066. These chips use a 0.68-micron CMOS design operating at 3.3V and are second-sourced by Mitsubishi. We can't count these guys out yet. It'll be interesting to see how this continuing **thrust**, combined with the Power PC efforts by Motorola and IBM, affects Intel.

While on the Subject of Intel, Kudos to Andy Grove Dept.: I attended the Innovations '93 conference sponsored by Compaq and held in Houston. It was a showcase for Compaq's new machines and marketing strategies, under the **gulse** of a technology conference. Curiously, the technology sessions, which included some in-depth operating-system discussions, were **quite good**. I had expected a **preening vanity event**. What impressed me most was a keynote speech by Andrew Grove of Intel. If you get the chance to hear one of his speeches, do. Highly recommended. This was a stark contrast to the opening-day keynote by Compaq CEO Eckhard Pfeiffer, who reads his speeches in a dry monotone overlaid with a **strange Teutonic accent**. His pronunciation of the word individual can only be described as a genuine adventure. He needs a speech writer, too, as the speech was **riddled with cliches** and jaw-dropping non sequiturs. My advice: a class at the local community college. Today's CEO's have to be not just good

*The first computer maker
to do an inexpensive
pure-power machine for
the home will find an
eager market. The
less-than-serious home
users will be the ones
buying the Presarios
and PS/1 machines.*

but excellent at the podium.

Pfeiffer showed some charts indicating that the **home computer market is going to boom** in the next five years, bringing the total number of home machines to half of the total market. Compaq intends to get into the home immediately with a machine called the Presario (your guess is as good as mine regarding the name), which looks like a **redesigned IBM Model 25**. A yawner. Compaq also showed off its odd Concerto: a notebook, pen-based combo machine that, to me, is a **kludge** of parts and pieces all over the place. I didn't like it, but almost everyone else thought it was nifty.

Anyway, there is an **underlying—and false—assumption**

that the home market will demand less capable machines like the IBM PS/1 and this Presario machine, which is underpowered by today's standards. None of these companies see that the home market will be segmented more than the business market. As the business market moves toward client/server computing, it will slowly orient itself toward a **single point of upgrade**, as a matter of survival in a changing world. The few main servers will be the hefty Pentium cum PowerPC cum Alpha cum AS/400 megamachines with gigabyte drives and **huge** main memories. The workstations will be terminals or three-year-old 486 machines seldom upgraded. Businesses can't afford the expense of **upgrading 10,000 CPUs** every 18 months. The serious home computer user, though, can afford to spend \$2,500 every two years for a new box (keeping the monitor longer if it's wisely chosen in the first place). The real power machines will be found in the home and home office. The first maker to develop an **inexpensive pure-power machine** for the home will find an eager market. The less-than-serious home users will be the ones buying the Presarios and PS/1 machines. They won't spend much to begin with, and they won't keep spending to keep up.

In the Mac market, this is already happening. Some analysts were **aghast** when it was revealed that 75 percent of new Mac sales go to established Mac owners. Actually, this is a good sign and proves that a replacement market is where the action is. Although we haven't reached theoretical saturation of computers in the home and workplace, we can expect only modest growth of newcomers into the scene unless there is a **radical change** in the way the machines work and what they can do. Most people who need a **computer** have a **computer** (in case you haven't noticed). Many of us have quite a few, in fact. □

Desk



OFFICE

As the water level is lowered in the flask, the air inside expands and its pressure is reduced. As the pressure is reduced, the water level in the flask rises. The water level in the flask rises until the pressure of the air inside the flask is equal to the pressure of the water outside the flask.

CLIENT'S

Therefore, to be able to do this, the function is called
getenv which returns a pointer to the environment variable
whose name is the argument. If the environment variable
does not exist, the function returns a null pointer.
The user has to make sure that the environment variable is set
before the program is executed. If the environment variable is not set,
the program will not work properly. The user has to make sure that
the environment variable is set before the program is executed.



HOTEL

4. *How do the two systems differ in their assumptions regarding work life?* And, *what makes higher job satisfaction in the more traditional work life model than in the performance-based model?* The traditional model assumes that employees have a strong desire to work and a strong desire to be paid. The performance-based model assumes that employees have a strong desire to be paid and a strong desire to work. The traditional model assumes that employees have a strong desire to work and a strong desire to be paid. The performance-based model assumes that employees have a strong desire to be paid and a strong desire to work.

HOME

It is very common to find that a person's response to a stimulus is determined by the stimulus itself, rather than by the person's internal state. For example, a person's response to a stimulus is often determined by the stimulus itself, rather than by the person's internal state. This is because the stimulus itself provides information about the person's internal state, and the person's response is determined by this information.

optional.



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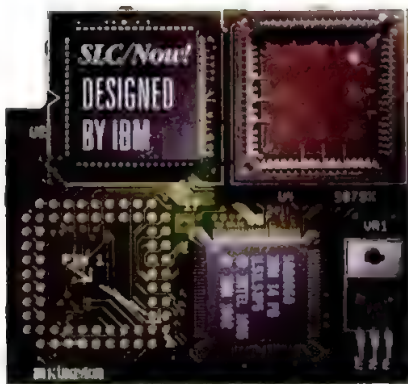
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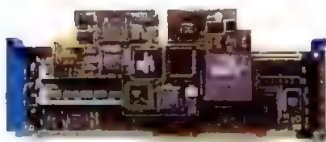


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Recount:	5:44 Min.	1:51 Min.	1:54 Min.	
Retail Price:		\$215	\$1,545	
SLC/Now!	PS/2 Model 50	With SLC/Now! 50	PS/2 Model 90-0H9	SLC/Now!
Landmark Speed 2.0:	13 MHz	114 MHz	84 MHz	IBM PS/2 Models 90, 90Z and 60
Recount:	3:34 Min.	:29 Sec.	:38 Sec.	
Retail Price:		\$425	\$3,280	
486/Now!	PS/2 Model 70-25MHz	With 486/Now! SX 25	PS/2 Model 90-0H9	486/Now!
Landmark Speed 2.0:	39 MHz	84 MHz	84 MHz	IBM PS/2 Models 70 and 80, Compaq Deskpro Models 386/16, 386/20, 386/20e, 386/25, 386/25e, 386/33
Recount:	:55 Sec.	:39 Sec.	:38 Sec.	
Retail Price:		\$495	\$3,280	
MCMaster	PS/2 Model 558X	With MCMaster SX 25	PS/2 Model 90-0H9	MCMaster
Landmark Speed 2.0:	16 MHz	84 MHz	84 MHz	IBM PS/2 Models 55, 56, 57, 65, 70, 80 and 90
Recount:	2:47 Min.	:36 Sec.	:38 Sec.	
Retail Price:		\$795	\$3,280	

All systems tested with 16MB installed except MCMaster tested with 5MB on-board and 16MB on mother board. All system prices are MRP at standard configuration as of 4/1/91. Processor upgrade prices are MRP as of 4/1/91. Recount conducted on IBM Excel for Windows spreadsheet generated by Kingston Technology.



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CIRCLE 106 ON READER SERVICE CARD



Jim Seymour

The Problem with PDAs

Too little, too early. That's my take on the PDAs we've seen so far and are likely to see for the next year or two. Apple's Newton sets the standard: It doesn't do enough—or even do what it *does* do well enough—to be really useful. I don't doubt that it's

going to sell well, especially as we head into the Christmas season. There's a bit of The Sharper Image in us all.

Yet I come not to bury Newton but to praise it, because it shows what's wrong with the present approach to designing personal digital assistants. It isn't just that the handwriting recognition needs to get better; it's that the PDA model is all wrong.

What we've seen so far in the Newton, the Casio Z-7000 and other almost-pocket-sized PDAs are attempts to cram a computing device into your pocket, with a little communications on the side.

That's exactly backwards. What I want, and what I think most people will want as the market evolves, is a communications device with a little computing on the side.

As computers, these little things are awful. And as communications tools, they're worse, because they focus on communicating according to the notebook PC paradigm. We already have pretty good notebook computers, guys; they're getting faster, smaller, lighter, and cheaper every day. PDAs aren't going to replace notebook PCs for years, so why do their designers keep trying to turn them into dim-witted notebooks?

Why not a new and different tool, with a different paradigm—something that I'll choose to buy *in addition* to a notebook PC, and *instead of* something else?

What I want, rather than a halfwit computer-wannabe, is a very smart, almost-pocket-size telephone, with a little backlit LCD screen. About half the size of the screen on the Newton will be fine, thanks. This is a cellular-based system, so it's truly mobile, usable anywhere.

Handwriting recognition? Sure—to a useful end.

I want to be able to scribble a few block letters on that screen, with a high degree of accuracy in their recognition by the system.

What am I going to scribble? The first few letters of a name, usually, because I want to be able to download my name/address/telephone database into the device from my PC and then search for numbers by entering the first few letters of someone's last name. As I enter each letter, the search for the right name will narrow.

CALLING BILL MACHRONE

Thus when I want to call Bill Machrone, I'll draw an M, and the scrolling list on the display will roll to the top of the M's. As I enter the A, the device will zero in on the first entry beginning with *Ma*. As I draw my C it'll zero in on *Macs*, and by the time I draw the block H—if I get that far—I'll have my half-dozen listings beginning with *Mach* showing on screen. When I see the one I want, I'll tap the name once or twice, and the device will put through the call.

As I put through the telephone call, or during the conversation, touching an easy-to-find button will turn on a digitized voice recorder, which captures all or part of the conversation to a PCMCIA flash RAM card in the device. Thanks to very high compression, I'll be able to store a lot more speech on that card than I need, and later I'll be able to download that conversation to a notebook or desktop PC through the device's infrared link.

I'll also be able to play back the recorded conversation anytime I want, through the device's earpiece, so I won't have to make notes while I'm still talking.

My built-in phone list will also have my contacts' fax and pager numbers, so I



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Mode/ Status	Power Consumption Proposed by EPA	KFC's Green Monitor	
		Power Recovery	Power consumption
ON (Max.)	N/A	N/A	17*(100W), 15*(70W)
*Stand-By (Suspend)	N/A	Auto / < 1 sec	< 20W
OFF	< 30W	Auto / < 15 sec	< 1.5W (In AC120V) < 3.0W (In AC260V)

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Jim Seymour

can scribble a very brief (10- to 20-word) message to someone like Bill and have it faxed to him, or sent to his pager just as easily. The device will receive brief faxed or paged messages, too, of course—but it won't try to act like a PC fax-card-based system, receiving conventional 8.5- by 11-inch-page-size images, since there's no way I'll be able to read them on that small screen. I'll give my unit's telephone number only to people from whom I want to receive these brief scrolling faxes and pages and voice calls.

Of course, the unit will auto-detect incoming calls as voice or fax and switch into the correct mode.

NO SPECIAL STYLUS

I don't want to have to use any kind of special stylus to scribble on the unit's screen: The screen will be sufficiently tough that I can scrawl with anything short of a needle without damaging the writing surface. And if I use a ballpoint or rollerball pen, I'll be able to wipe that ink off the surface with a damp tissue.

The unit will have other functions, too, from a graphical, keep-zooming-for-more-details appointment book to a reminder alarm (audible or vibrating) or a notepad-scratch-memory space that lets me save and later retrieve and download random jottings over that IR link to my notebook, if I wish.

So what do I have here?

First, it's a truly useful business tool, because it mimics but expands substantially on the functions of my existing cellular phone. It exploits my familiarity with the operation and benefits of a cellular phone, while also adding enough value to persuade me to make the new investment.

Second—and this is key—because it replaces something I presently carry, it doesn't increase my load.

There's just one problem with this device: It's about two years off. The current state of the art in the technologies needed to make it aren't up to its demands. I'm not saying vendors shouldn't build PDAs until every piece is in place to allow them to build great products. But there is a threshold of pain—a threshold of usability—not yet crossed by PDAs.

But soon—say, about two years from now—we'll see some really useful PDAs, communications-centered devices, not pseudo computers. Until then, I'll keep my money in my pocket, thanks.□



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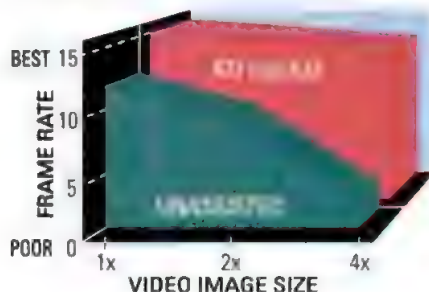
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CIRCLE 228 ON READER SERVICE CARD

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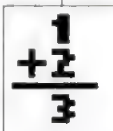


individual productivity in excess of 20%. And a return on investment of 330%. In the first year.*

For example, a corporation with 500 users would spend about \$59,500 to upgrade to 1-2-3 Release 3.4. Based on a productivity model which considers the cost of training and support, this corporation would save over \$200,000 annually in support costs as a result of the upgrade. No matter what size your company is, upgrading to 1-2-3 R3.4 will save you money and increase your productivity.

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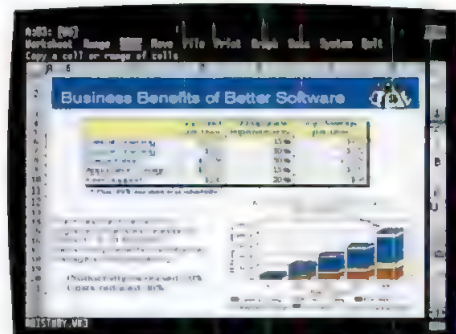
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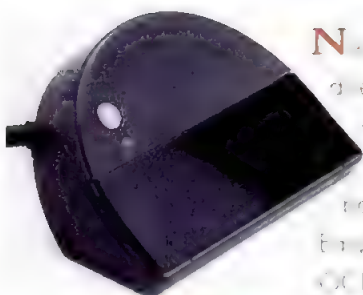
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Bill Howard

You'll Love PCMCIA...Eventually

You remember the advice, "Never buy a new car model the first year it comes out." You're supposed to let someone else be the guinea pig. You could say the same, and more, about PCMCIA, the three-year-old specification for credit-card-size laptop

and now desktop PC devices such as modems, LAN adapters, memory cards, and wireless communicators.

We're near the end of the guinea pig phase. PCMCIA has become the only type of I/O expansion currently offered on most new laptops. If you don't like it, the only alternative is to buy a bulky external device. PCMCIA is important now. But remember, it will be more important in the next year, not only for portables but also for desktops.

PCMCIA is pronounced "PCM (pause to catch your breath) CIA," and stands for the Personal Computer Memory Card International Association. The joke around the industry is that it also stands for People Can't Memorize Computer Industry Acronyms. It would be only a little bit unfair to say that the shakers and movers of PCMCIA seem to be more ivory-tower technologists than everyday end users worried about dialing up the office LAN using PCMCIA card-equipped laptops in a hotel room. Otherwise, PCMCIA compatibility and usability wouldn't be in the sad state they're in today.

NEVER TOO THIN?

For most of us, the PCMCIA slot means the modem slot. But you can't attach a phone cord directly to a PCMCIA modem card, because the largest ratified PCMCIA card size is too thin for standard RJ-11 phone jacks. Since a PCMCIA slot is meant to hold so many different I/O devices, the PCMCIA committees opted not to set aside two of the 68 pins on the PCMCIA connector for modems. Bad mistake. If they had, laptop makers could have built RJ-11 connectors into their laptops, wired to a PCMCIA connector. Now we're stuck with a fragile, hard-to-replace card-to-RJ-11 adapter cable.

The broader problem is the faded promise of universal plug-and-play. Two

years ago, Release 2.0 of the PCMCIA spec (not 5-mm-thick PCMCIA Type II cards) required virtually any portable device to accept, identify, or configure virtually any PCMCIA card. Intel's ExCA (exchangeable card architecture) promised the same on PC-compatible portables. It's not happening.

Instead, the shorter-range goals are for PCMCIA card vendors to describe their cards' requirements so you'll know if they *should* work in your laptop, and for vendors to certify that specific cards *will* work in your laptop.

CARD SAVVY

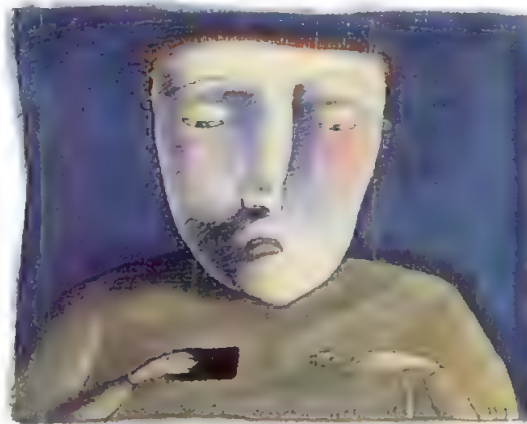
Here are some specific suggestions on making the most of PCMCIA today:

Go ahead and buy PCMCIA laptops. You'll find a wide variety of capable PCMCIA I/O devices. In particular, PCMCIA LAN cards are noticeably faster than parallel-port LAN adapters. I suggest getting a portable with a 10.5-mm Type III slot that holds one Type III card or two stacked Type II (5-mm) or Type I (3.3-mm) PCMCIA cards.

Buy a spare modem-to-RJ-11 adapter for the office or home. When you lose or break the one that came with the PCMCIA modem, just call for overnight express.

Check PCMCIA certification by laptop vendors. Until plug-and-play is real, look at laptop vendors that lab-certify specific PCMCIA cards. I've been especially impressed by the certification work of NEC Technologies and IBM.

Toshiba has the best modem solution. It essentially thumbed its nose at the PCMCIA committee and built a 16-mm-tall "unofficial Type IV" socket and corresponding high-speed fax modem. Just insert and use PCMCIA Type I, II, or III cards in a 16-mm socket. I've used this. It's wonderful. □



*PCMCIA: We all love
the size, but when will it
really grow up?*

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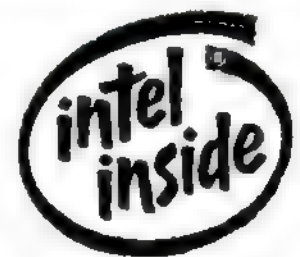
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Contura Features

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10th Annual Printer Issue

• PC LABS FINDS NEW

by Bill Howard

ive hundred dollars for a laser printer. You younger members of the PC family, pardon us old-timers for a moment while we turn nostalgic. Five. Hundred. Dollars. Since our first printer issue hit the stands ten years ago, we've come from \$1,500 daisy wheel printers to \$1,500 laser printers to \$500 laser printers today.

The low-cost 4-page-per-minute laser printer that lists for \$600 to \$700 and sells for \$499 or less on the street represents the most important of a half-dozen or so major

Laser printers for \$500, stunning color for under \$2,000, faster performance, higher resolution, better network management: You'll find them all among the 105 printers we tested for this year's annual blockbuster.

PRICE/PERFORMANCE LEVELS

The U.S. Printer Market

Ink jet sales skyrocket; laser growth continues.

U.S. PRINTER SALES, 1992 TO 1994

Units shipped	1992	1993*	1994*
Dot matrix	5,489,970	5,191,800	3,826,500
Ink jet	1,664,000	2,105,600	3,113,500
Laser	2,552,290	2,862,440	3,294,400
Other	111,100	122,500	117,600
Total sales	9,817,360	10,282,340	10,352,000

*Sales figures for 1993 and 1994 are projected.
Source: BIS Strategic Decisions

LEADING MANUFACTURERS, 1992

	9-pin dot matrix	24-pin dot matrix	All dot matrix	Ink jet	Laser
1	Epson	Panasonic	Epson	Hewlett-Packard	Hewlett-Packard
2	Okidata	Epson	Panasonic	Canon	Apple
3	Star Micronics	Citizen	Okidata	Apple	Okidata
4	Citizen	Star Micronics	Star Micronics	Eastman Kodak	Panasonic
5	Panasonic	Okidata	Citizen	Lexmark	Lexmark
6	Apple	Lexmark	Lexmark	Star Micronics	Epson
7	Lexmark	NEC	Apple	Digital	Texas Instruments
8	ALPS	Digital	C-Tech	Olivetti	NEC
9	Texas Instruments	C-Tech	ALPS	Brother	Digital
10	Digital	ALPS	Digital	**	QMS

** Only nine manufacturers of ink jet printers have a significant presence in the PC-compatible marketplace.
Source: BIS Strategic Decisions (based on 1992 unit sales)

trends among the 105 printers we reviewed this year.

Some other trends include: more 600-dot-per-inch laser printers, further segmentation of the laser printer market into high-speed (12-ppm and up) network lasers and slow (6-ppm and below) personal lasers, energy-efficient lasers, sub-\$1,000 PostScript Level 2 printers, tremendous sales growth among ink jet printers, resilience of the supposedly fading dot matrix printer market, and tremendous improvement in quality among color printers.

MARKET TRENDS

U.S. printer sales will increase 5 percent this year, reaching 10.3 million units, according to BIS Strategic Decisions, a Norwell, Mass., market research firm. (In comparison, BIS projects 13.7 million PC sales this year in the U.S.) Projected activity in individual segments of the printer market ranges from sensational (ink jet printers, up 27 percent) to solid (laser printers, up 12 percent) to handwriting-is-on-the-wall (dot matrix printers, down 5 percent). But the dot matrix market is far from dead; in unit volume, it should

still account for a shade over half the printers that will be sold domestically in 1993.

The biggest growth and the most sales are happening at the high and low ends of the printer market among high-speed network laser printers and affordable personal laser, ink jet, and dot matrix printers.

LASERS: WHO CAN CATCH HP?

The majority of the mainstream laser printers we tested have engines rated at 4, 5, or 6 ppm, and their prices are well below \$1,000. In fact, two of the printers we tested commonly sell for less than \$500.

Hewlett-Packard brought out two sets of 4-ppm printers this year: The 300-dpi HP LaserJet 4L (PCL 5) and HP LaserJet 4ML (PostScript and PCL 5) are based on the Canon PC engine. The more recent 600-dpi HP LaserJet 4P (PCL 5) and 4MP (PostScript and PCL 5) are based on the Canon PX II engine. The LaserJet 4L sells for about \$650—now the de facto price ceiling for a low-end 300-dpi laser printer. The LaserJet 4P sells for about \$945, and the 8-ppm, 600-dpi HP LaserJet 4, introduced last year, sells for about \$1,400.

HP's 4-ppm printers include a variety of bells and whistles, including HP's Memory Enhancement Technology, a data-compression technique that lets you print a full page of PCL graphics with just 1MB of printer memory; a draft mode, which uses half the usual amount of toner; and better two-way communication between printer and host PC. These extra features are why HP can sell a \$500-class printer for \$650.

As a group, laser printers have become even more compact, quiet, and energy-efficient. To reduce footprints (the area the machine occupies on the desktop), most lasers now have paper drawers that slide completely inside. The \$649 Panasonic SideWriter KX-P4400 and \$999 Panasonic SideWriter KX-P5400 (PCL- and PostScript-based, respectively) actually stand upright and look like mini-tower PCs.

Microsoft's TrueType scalable-font technology makes PostScript less of a must-have for business users. But for users sending material to typesetters or

Our Contributors: BILL HOWARD is an executive editor and FRANK J. DERFLER, JR., is the senior networking editor of *PC Magazine*. OLIVER RIST is a staff writer and BRAD STILWELL is an editorial researcher at *PC Magazine*. BRUCE BROWN, EDWARD MENDELSON, ALFRED POOR, and M. DAVID STONE are contributing editors of *PC Magazine*. MARGARET PIEMONTE is a technical analyst at *PC Magazine*. STEPHEN C.M. CHEN, JOSEPH DESPOSITO, LORI GRUNIN, ANGELA GUNN, JAMES KARNEY, GREG PASTRICK, and STEPHEN W. PLAIN are frequent contributors to *PC Magazine*. BILL DYSZEL, HAL GLATZER, PATRICK HONAN, and TED NEEDLEMAN are free-lance writers. Leon Erlanger was the associate editor in charge of this story, and MICHAEL J. ZULICH was the project leader. John Clyman is a staff editor and Mary E. Behr is an editorial researcher at *PC Magazine*.

film recorders, there's still a strong comfort factor in using Adobe-branded PostScript. Two printers, Digital Equipment Corp.'s DECLaser 1152 and the Panasonic SideWriter KX-P5400, offer the more capable PostScript Level 2 at list prices of just under \$1,000.

COLOR PRINTERS

Color printers that produced great output used to cost \$5,000 to \$12,000 and require Adobe PostScript. They also used thermal wax transfer, solid-ink (phase

change), or thermal dye transfer technology. These technologies have improved in quality this year, but they're being challenged by a less expensive alternative: the ink jet. The PCL-only HP DeskJet 1200C (\$1,699) and PostScript-capable HP DeskJet 1200C/PS (\$2,399) are ink jet printers that produce excellent business graphics as well as high-quality monochrome output, meaning that one device can be both a monochrome and color printer without sacrificing quality either way.

QMS has announced (but did not ship in time for our deadlines) a color laser printer, the \$12,500, 2-ppm QMS ColorScript Laser 1000. Print samples that we saw suggest the unit will be great for spot color, business graphics, and high-lighting.

INK JET: MONOCHROME FOR NOW

Ink jets are \$150 to \$200 less expensive than the cheapest laser printers, which means that you can buy one for as little as \$300. You get almost laser quality for less than

Print Technologies: How to Decide

This summary outlines the pros and cons of the five major printer categories. These comments apply to most printers within each category; some will fall outside. High-end color ink jet printers such as the HP DeskJet 1200C should also be considered color printers. The cost per page does not include paper costs (which normally runs about a penny a sheet). The speeds of laser and dot matrix printers are not directly comparable, but a rough rule of thumb is that 1 page per minute (ppm) from a laser printer equals 30 characters per second (cps) printing a full page of double-spaced text, or 60 cps printing single-spaced text.

	Dot matrix	Ink jet	Personal laser	Shared laser	Color
Pros	Inexpensive, with low-cost output. Can handle multipart forms and wide paper.	Quiet, compact, inexpensive—\$150 to \$200 less than the cheapest laser. Some print up to 17 by 22 inches.	High print quality, very quiet. Under-\$500 prices for basic models, meaning you can have one on every desktop.	Good print quality. Very fast, especially with direct network hookups. Some handle 11- by 17-inch paper and have multiple bins.	High-quality color output at high resolutions. Ideal for business graphics. Output can sometimes approximate color photographs.
Cons	Noisy. Average print quality; graphics show banding. Few built-in fonts.	High per-page costs. Occasional streaking and smudging.	Significantly higher per-page cost than with dot matrix printers.	Difficult installation. Needs an internal network card to reach full potential. Output not at user's fingertips.	Bulky, extremely slow; high hardware and per-page costs; output not quite photograph-quality.
Speed	Personal models, 25 to 200 cps; forms printers, to 300 cps. Printing in quality mode reduces speed.	30 to 100 cps. Quality-mode speed decrease is less than that of dot matrix.	Personal models, 4 to 6 ppm; desktop models, 6 to 10 ppm. Need RISC processors for fast graphics performance.	12 to 30 ppm.	Usually 1 ppm or slower.
Cost	Personal models, \$100 to \$500; heavy-duty models, \$500 to \$2,000; line printer emulators, \$5,000 to \$10,000.	Monochrome and portable models, \$275 to \$500; color models, \$600 and up. Prices are falling fast.	Personal models, \$500 to \$1,500; desktop models, \$1,500 to \$3,000. PostScript adds \$200 to \$500.	\$3,000 to \$20,000. Direct network connection adds \$200 to \$600.	Ink jet models, \$600 to \$3,500; thermal wax, thermal dye, solid-ink models, \$3,000 to \$10,000.
Cost per page	Under 1 cent.	4 to 8 cents (some as low as 2 cents).	1 to 5 cents (3 cents is typical).	1 to 3 cents.	\$0.50 to \$1.00 (thermal dye is more expensive).
Output quality	24-pin quality mode, moderately good; 9-pin mode, fair. Quality falls off as ribbon ages.	Almost laser-quality.	Excellent text, good graphics. Many offer 600-dpi resolution and resolution enhancement.	Excellent text, good graphics. Many offer 600-dpi resolution and resolution enhancement.	Vibrant ink jet and thermal wax output, saturated thermal dye output. May have trouble printing fine lines.
Color	Inexpensive upgrade or special version.	Some models.	Not available.	Only with the \$12,500 QMS ColorScript Laser 1000.	Standard.
Noise	Loud; slow in quiet mode.	Virtually silent.	Quiet.	Quiet.	Quiet.
Size	Narrow-carriage models fit easily on desktop. Some small enough to take on the road.	Very small, except for some models with horizontal paper trays.	4- to 6-ppm models, footprint slightly larger than letter-size paper. 8- to 12-ppm models may be too large for desktops. Internal paper trays reduce footprint.	Usually need separate table or stand, but some barely larger than personal laser printers.	Very bulky and can overwhelm a small office.
Paper	Tractor-feed or continuous multipart forms, cut sheets.	Cut sheets, overhead transparencies, labels, envelopes. Porous stock not recommended.	Cut sheets, overhead transparencies, labels, envelopes.	Cut sheets, overhead transparencies, labels, envelopes.	Best results on coated stock or transparencies.
Common options	Cut-sheet feeder, color upgrade, Mylar ("carbon") single-strike ribbon.	None.	Second paper cassette, envelope feeder, duplex, PostScript.	Additional paper cassettes, duplex, internal network card, duplex, hard disk (for font storage), PostScript.	Network interfaces.
Energy efficiency	Naturally efficient.	Most energy-efficient printing technology.	Some meet Energy Star spec (under 30 watts when idle). Others use 30 to 100 watts.	50 or more watts when idle, up to 1,000 watts when printing.	Typically idle at about 50 watts. Power-saving modes rare.
Future outlook	9-pin market fading, 24-pin market dropping off. Dot matrix market still makes up half of total printer sales.	Fastest growth. Will be the largest market segment by 1996. More tabloid-size color models coming.	4- to 6-ppm market growing fastest. 8- to 10-ppm sales declining. Market moving toward 600 dpi.	Growth outstrips that of 8- to 10-ppm lasers. Look for more paper-handling options, better remote management, low-power rest modes.	Prices falling. Thermal dye may match photo quality. Ink jets are beginning to compete as professional graphics printers.

Thumbs up, thumbs down

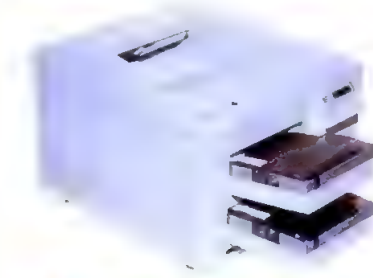
Some of the features that particularly caught our attention among this year's reviewed printers:



Clear Controls: The \$1,599 IBM 4039 10R (pictured) and the \$2,199 IBM 4039 10R Duplex, from Lexmark, have the best control panels we've seen. The large LCD panel clearly indicates what functions each button performs, and it's impossible to get lost in the menu structure.



Small Footprints: The \$999, 4-ppm Panasonic SideWriter KX-P5400 (pictured) and the \$649, 4-ppm Panasonic SideWriter KX-P4400 (just released) stand upright like a tower PC to achieve the smallest footprint of any laser printers yet.



Remote Management: Hewlett-Packard's \$5,499, 17-ppm HP LaserJet 4SI MX (pictured) provides extensive remote management through the included JetPrint and JetAdmin software, including .WAV file events to signal errors. It also lets you modify the printer control panel from a PC.



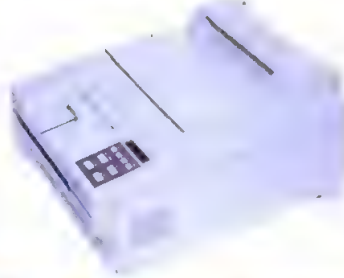
Automatic Paper-Thickness Adjustment: Okidata's OkiSmart Paper Handling—found in its Microline 500-series dot matrix models, including the \$599 Microline 520 pictured here—automatically adjusts the printhead to compensate for stock of differing thickness.



Low Power Consumption: Hewlett-Packard's four new 4-ppm laser printers use virtually no power when idle. The \$849 HP LaserJet 4L (pictured) draws only about 4 watts when not printing—so little, HP decided not to provide a power switch at all.



Networked Ink Jet: The \$1,699 HP DeskJet 1200C and \$2,399 HP DeskJet 1200C/PS (pictured) ink jets pair stunning color output with reasonable prices. When the DeskJet 1200C/PS or DeskJet 1200C runs out of one color of ink, though, it keeps humming away without notifying you; in a networked environment, you need to check periodically to make sure the unit hasn't run dry.



Page Preview: Three laser printers—the \$849 Citizen ProLaser 8000 (pictured), the \$1,449 Panasonic KX-P4440, and the \$999 Panasonic SideWriter KX-P5400—let you pause after the first page of a job to check that fonts, margins, and content look right before printing continues. This feature is a convenience as well as a paper-saver; you don't have to turn off the printer to cancel an errant job.



Awkward Labels: Labels on the \$399 IBM 2380 Plus (pictured) and the \$429 IBM 2380 Plus dot matrix printers indicate the secondary function of each control-panel button more prominently than the primary one—an ergonomic bungle that would be easy to correct. You do get an "operator's panel lockout" feature that disables controls except those for feeding and aligning paper.

PC Magazine Reveals:



The Computer That
Gives You The Most
Bang For The Buck.

Others pale in comparison. There's no way to dispute it! The results are in, and the ZEOS Upgradable 486DX2-66 is "the overall performance winner."

PC buyers expect low prices, top-quality, impeccable performance and prompt support. Basically, they want the most bang for their buck. *PC Magazine* recognized this and compared value-line PCs with more traditional systems to see if they were "truly good values or stripped-down machines trying to pass for good buys." The results are overwhelmingly in ZEOS' favor.

In fact, *PC Magazine* said: "ZEOS doesn't sell a separate value line, but the flexibility of its main system may be the least confusing solution of all."

THE WINNING SYSTEM

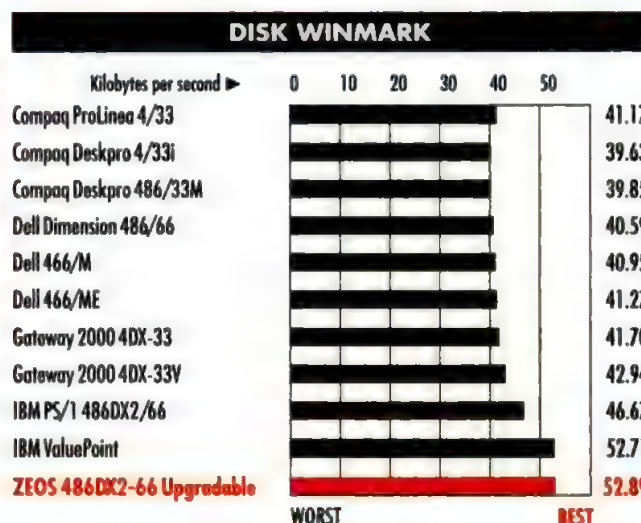
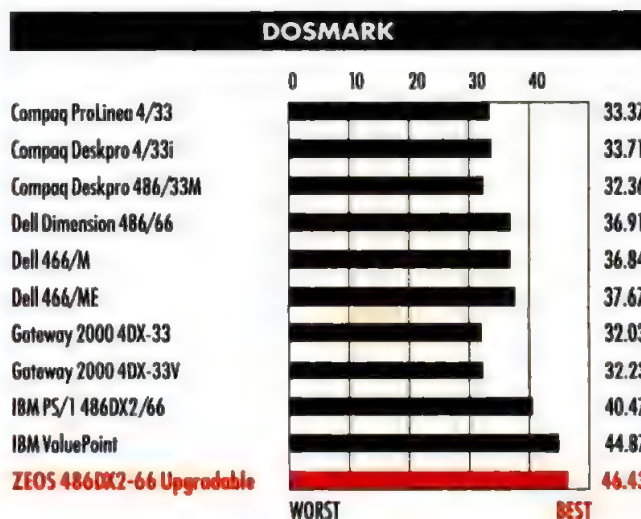
Stacked against Gateway, Dell, Compaq, IBM and others, ZEOS stood alone. Using the benchmark tests as a guide, *PC Magazine* made these conclusions:

"The clear winner is ZEOS' Diamond Viper VLB card in the ZEOS Upgradable, which turned in an incredible score of 55.01 megapixels per second."

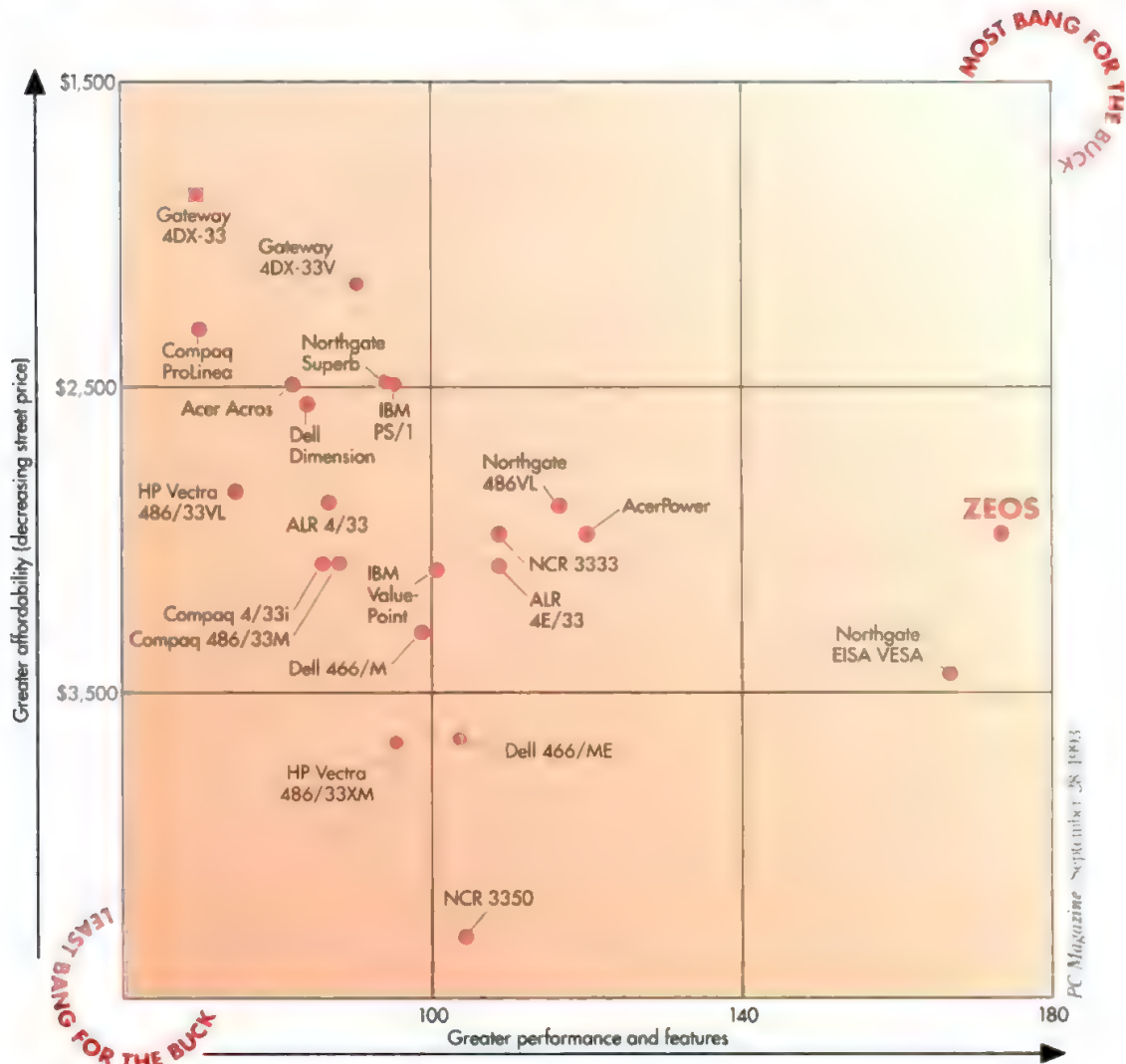
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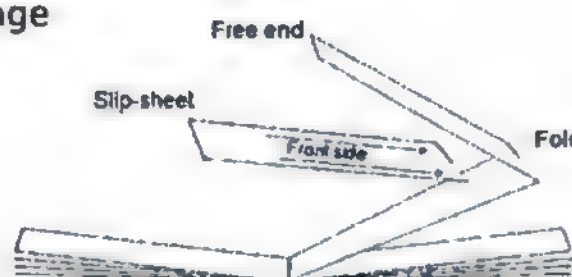
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2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet



GbsSlipSheet-001

Inverted Foldout slip-sheet

Folded edge of the page

1. Open the foldout page

2. Insert this sheet with

1. Front side touching the free page

2. Arrow pointing to the fold

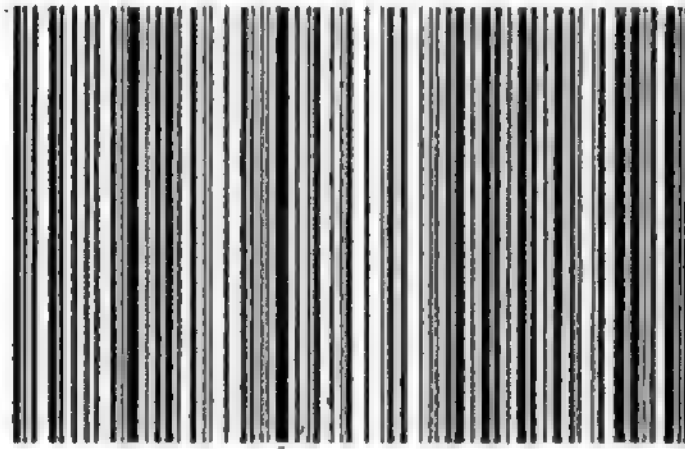
3. Slice the folded edge

4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



Gbs5lpBack-0018

Back

1. Follow instructions on the other side

"The ZEOS 486DX2-66 Upgradable's hard disk performance was almost 31 percent above the average in this roundup."

"As DOSmark scores are heavily weighted for processor and hard disk performance, the ZEOS garnered the first-place position in that category as well."

"...It was the top performer in Windows graphics and on DOSmark and DOS disk tests."

Of the "systems that demonstrated the best agility under strenuous exercise of all their components...ZEOS (scored) 26 percent above average."

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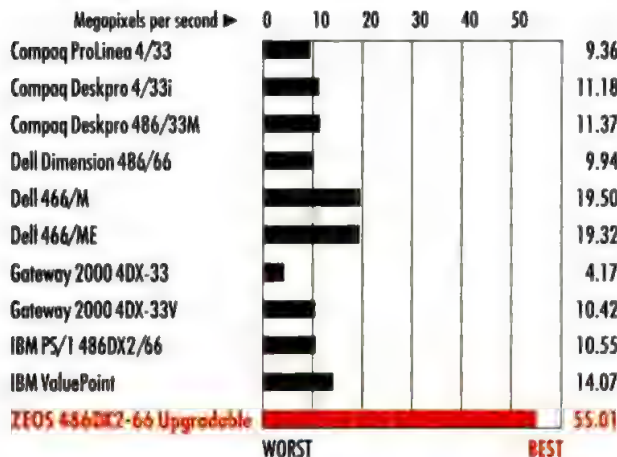


ahead to your future needs and technological advances; therefore, we include such features as CPU upgradability to Intel's Pentium OverDrive; a Zero

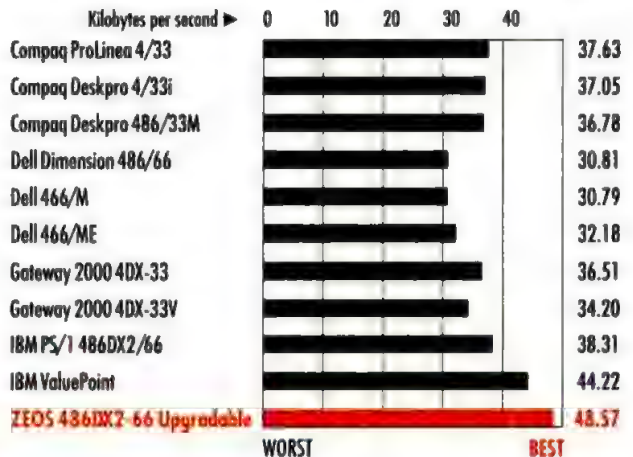
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Plus, you can choose from one of our money-saving packages, or we can custom build a system to your exact specifications. Feature for feature, no one gives you more than ZEOS. At any price, anywhere. *It is the biggest bang for your buck!* So why not give us a call? Your systems consultant can be reached at 800-554-7172.

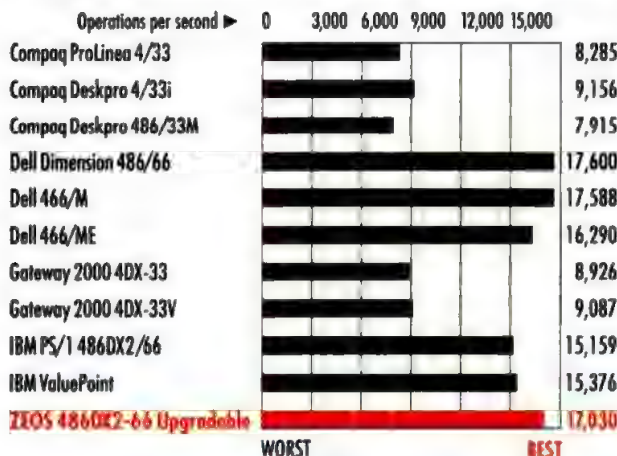
GRAPHICS WINMARK



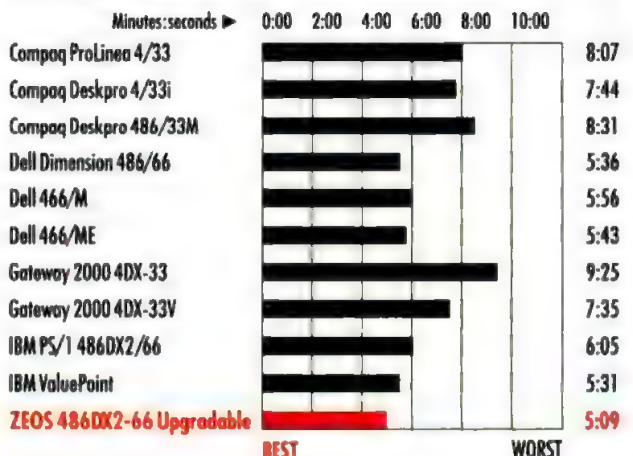
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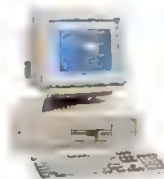
486
SX-25



486
DX-33



486
DX-33



486
DX2-66

PACKAGE #2:

- 4MB RAM
- 214MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$1695

PACKAGE #2:

- 4MB RAM
- 214MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

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PACKAGE #3:

- 8MB RAM
- 426MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

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PACKAGE #3:

- 8MB RAM
- 426MB local bus hard drive with built-in 128K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$2495



486
DX2-66



486
DX2-66



486
DX2-66



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PACKAGE #3 BONUS:

- 8MB RAM
- 256K SRAM system cache
- 528MB local bus IDE hard drive
- Diamond Viper local bus video card
- 15" SVGA color monitor
- Both floppies
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- DOS, Windows, Mouse
- Choice of Windows application

\$2995

PACKAGE #4:

- 16MB RAM
- 528MB local bus hard drive with built-in 256K cache
- Windows-accelerated local bus video
- SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$2995

PACKAGE #4 PLUS:

- 16MB RAM
- 528MB local bus hard drive with built-in 256K cache
- Diamond Viper local bus video card
- Vertical case
- 15" SVGA color monitor
- Both floppies
- DOS, Windows, Mouse
- Choice of Windows application

\$3334

PACKAGE #1:

- 4MB RAM
- 107MB hard drive with built-in 32K cache
- Both floppy drives
- SVGA color monitor
- DOS, Windows, Mouse

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Birthdate / /	Social Security Number	Home Phone ()	Business Phone ()	
Name of Relative or Friend (Not living with you)		City and State	Relative/Friend Phone ()	
Your Employer (Or business name if self-employed)			How Long (Years)	
Annual Income From All Sources (Alimony, child support or separate maintenance income need not be disclosed unless relied upon for credit.) \$				
Occupation/Group (✓ One)				
☐ 1. Professional/Technical ☐ 2. Sales ☐ 3. Clerical ☐ 4. Self-Employed ☐ 5. Retired ☐ 6. Other				
# Dependents	Do You (✓ One) ☐ Own ☐ Rent ☐ Live w/Relatives	How Long (Years)	Mortgage/Rent Payment \$	
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If Your Credit References Can Be Verified In Any Other Name, List That Name Here				

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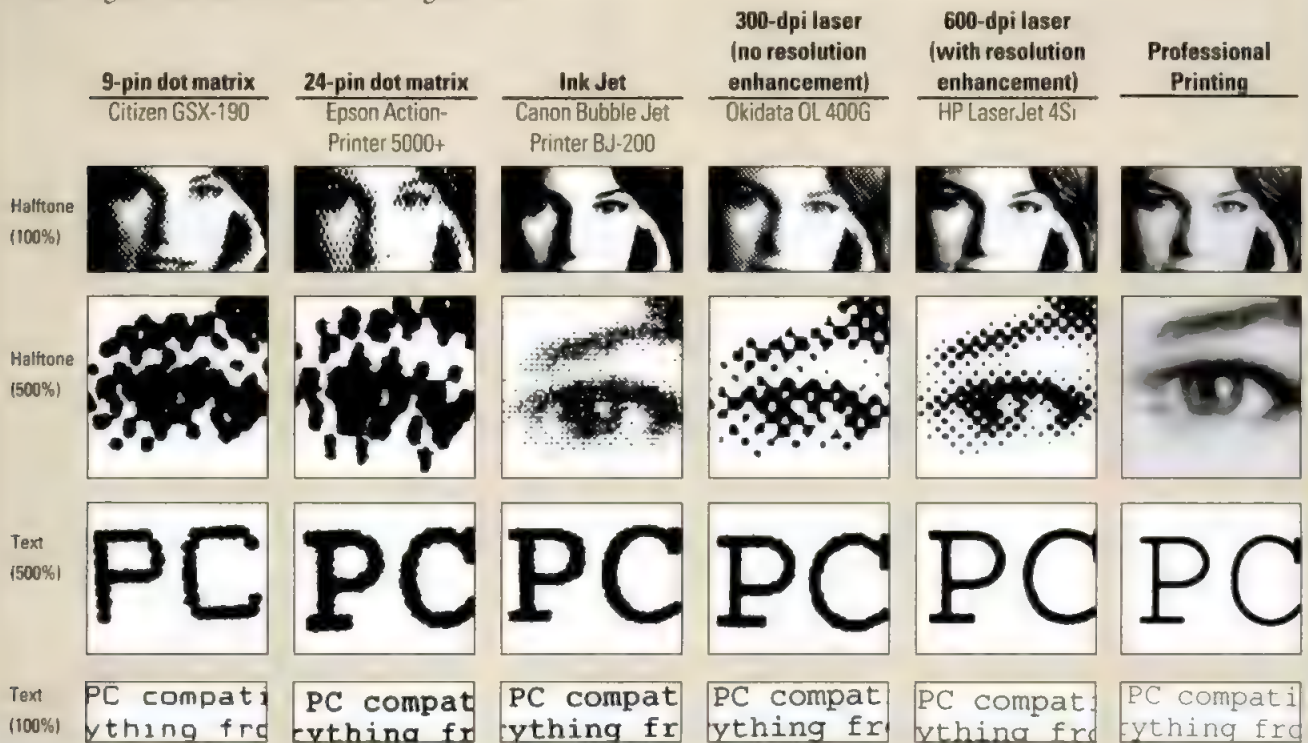


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■ Print Technologies: *Comparing the Output*

This illustration shows representative output samples for the major printer types and for a professional offset printing process. A halftone image and a text sample are reproduced here at the original size and five times the original size.



laser prices, though per-page costs are higher. Five of the six ink jet printers reviewed here are monochrome-only. The sixth is a returning Editors' Choice, the \$719 HP DeskJet 550C. (The only other new color ink jet printers this year are also from HP. Since they are priced more comparably with units based on traditional color technologies like thermal wax transfer, they are in the Color Printers section.)

We expect the popularity of ink jets to grow because they can provide decent color capabilities or tabloid-size (11- by 17-inch) output for prices only incrementally higher than the cost of letter-size monochrome printers.

Traditional players in the ink jet market—HP, Canon Computer Systems, and Eastman Kodak Co.—were joined this year by dot matrix leader Epson America. Panasonic Communications & Systems Co., the leader among makers of 24-pin dot matrix printers, says it too will be in the market soon.

DOT MATRIX

Since 1990, industry analysts have said dot matrix sales would peak and then begin to fall the following year. This year, they're finally right. But it will be a slow decline.

There's little new in the way of technology. You've seen the scalable fonts and low-noise technologies before. Advances in cost engineering, however, have brought the cost of 24-pin printers to less than \$200 and 9-pin-printer price tags down to almost \$100. If you want the lowest per-page costs, or if you want to print forms, dot matrix is still the way to go.

GREEN PRINTERS

The printers in this year's issue use fewer resources and less energy than their predecessors. Partly that's due to the Environmental Protection Agency, which now certifies as Energy Star-compliant printers that use less than 30 to 45 watts when idle. We conducted our own power-consumption tests on laser and color

printers this year; results are reported alongside performance numbers in each section. (We didn't test ink jet or dot matrix printers because they're naturally efficient already.)

If your idea of conservation is saving money on per-page costs, consider the 18-ppm Kyocera Ecosys a-Si Printer FS-3500A, big brother to last year's Editors' Choice, the 10-ppm Kyocera Ecosys a-Si Printer FS-1500A. Because of their long-life amorphous silicon photoconductor drums, costs run about 0.8 cents per page (plus a penny a page for the paper). This compares with a laser printer's typical per-page cost of 3 cents. And HP, long an opponent of reusing toner cartridges, now offers an HP-branded, recycled, remanufactured toner cartridge called Optiva.

FUTURE TRENDS

Looking ahead to 1994, you can expect to see virtually every laser printer have a



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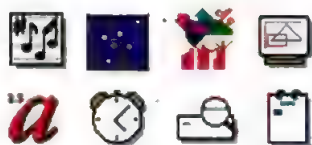
Can your PC pass this simple screen test?



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and I'll name it
anything I want

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Benchmark Tests: Printers

As printer features evolve, so do PC Magazine's printer tests. This year we've expanded and tuned our already extensive battery of tests so they better address emerging trends, such as 600-dot-per-inch laser printers, support for Adobe PostScript Level 2 or Level 2 PostScript emulators, and power-saving features.

How We Tested

Shown here are some components of the tests we use to judge printer performance and output quality. Many of these tests, such as the Arthur D. Author letter we use to measure text speed, remain unchanged from past years. Others, including the Lotus 1-2-3 for Windows application test, are new. In "How to Read the Printer Guides" (below), we describe the methods we use to derive performance scores and judge output quality. For easy reference, we've included a sample printer output guide—a compilation of price and features, graphics and text samples, and graphics and text printing performance-test results.

New this year is our Power Consumption test, for which we use a Dranetz Series 808 Electric Power Demand Analyzer to record each printer's energy usage when printing, idle, and in power-saving sleep mode (if one is provided). We report the results of our

power-usage tests alongside our traditional test-result charts. We also checked to see whether the printers were compatible with HP PCL 4, HP PCL 5, and Adobe PostScript Level 1 and Level 2, using tests that stress both common and

*Our new Power
Consumption test records
each printer's energy
usage when printing, idle,
and in power-saving
sleep mode.*

infrequently used features of these page-description languages to uncover limitations in each manufacturer's implementation. We discuss these findings, when appropriate, in the printer reviews.

TEST ENVIRONMENT

We conducted all tests on a Compaq Deskpro 486/33M equipped with 8MB of RAM and a 310MB hard disk. For Windows applications tests, we installed Windows in its default configuration, including a 2MB SmartDrive cache. We turned off virtual memory to eliminate effects of disk spooling, and the Windows Print Manager was bypassed to avoid introducing additional overhead. We conducted all the printer speed tests via the parallel port.

GRAPHICS SPEED AND CORELDRAW TESTS

We use the same page of graphics for both the Graphics Speed test and the CorelDRAW Windows application test. The page at right was created in CorelDRAW; for the CorelDRAW test we time the printer as it produces this page from the application using the supplied Microsoft Windows driver. For the Graphics Speed test we time the printer as it produces the same page from a print file sent directly from DOS.

This page is also useful as a guide to the printer's output quality. In the halftone image, we look for clarity and reproduction of fine detail in highlights and shadows. We use the horizontal and vertical gray scales to judge the printer's ability to reproduce different gray levels. The hairline rule rotated in 10-degree incre-

How to Read the Printer Guides

Performance test results

These results show how quickly the printer produces output. For dot matrix and ink jet printers, we report the text speed in both draft and quality modes. For laser printers, we show the performance in both HP PCL and PostScript (if supported). To allow meaningful comparisons, results for laser printers indicate performance at 300-dot-per-inch resolution, even if the printers support higher resolutions.

Graphics output

The photo shows how well the printer reproduces halftones.

Text output

This provides a sample of the printer's text output for a selection of built-in typefaces.

Line art

This shows how well the printer handles lines of increasingly large pixel widths, as well as curves.

Gray-scale or color output

This bar consists of six shades of gray for monochrome printers. For color printers, the bar displays six shades of gray and six colors.

HP LaserJet 4M

\$2,399

8-ppm laser printer (Canon EX engine) with 600-dpi output, Adobe PostScript Level 2, enhanced HP PCL 5

EDITORS' CHOICE

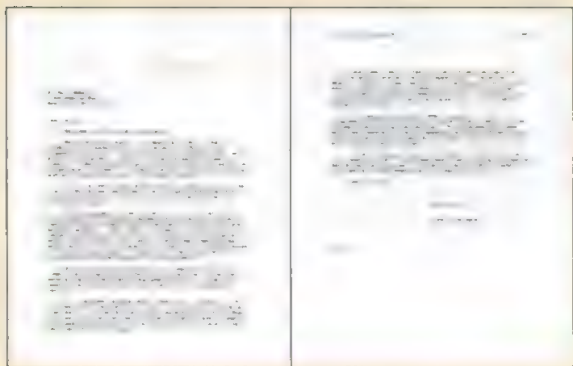
PCL Text Speed: 8.0 gppm
PCL Graphics Speed: 2.8 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 6.9 gppm
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 2.9 gppm

PS Text Speed: 7.8 gppm
PS Graphics Speed: 1.3 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 6.0 gppm
CorelDRAW: 1.3 gppm
Lotus 1-2-3 for Windows: 3.5 gppm

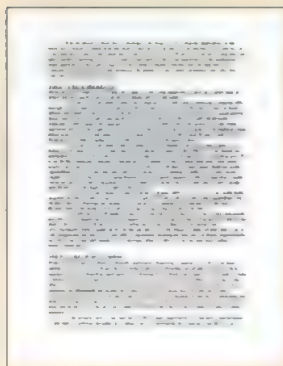


Avant Gard Palatino
Bookman Symbol Συμφ
Courier Times
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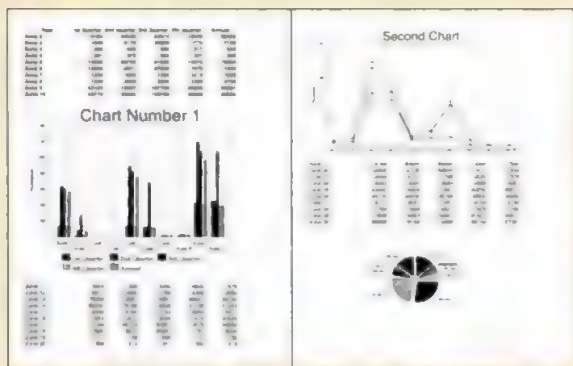




Text Speed test



Word for Windows test



Lotus 1-2-3 for Windows test



Graphics and CorelDRAW tests.

ments demonstrates the printer's ability to maintain a consistent line weight at varying rotations. The star-shaped figure at the upper right helps us check fine-edge quality.

WORD FOR WINDOWS TEST

Shown above is one page of the Word for Windows test document we use to test text-printing speed under Microsoft Windows. This document contains Arial and Times New Roman TrueType fonts in different sizes and styles.

We print a two-page document for dot matrix and ink jet printers. For laser printers, we print a ten-page document, which reduces the effect of the delay typically incurred while the printer prepares the first page. Since color printers are not generally intended for text-only output, we have omitted the Word for Windows test in the color-printers section.

TEXT SPEED TEST

The Text Speed test uses the same Arthur D. Author letter that we've

used since our first printer issue, in 1983. This test, which we run from DOS, provides a good indication of the printer's raw engine speed. Since we haven't changed the test, you can compare the speed result against those in all previous printer reviews.

For dot matrix and ink jet printers, we print the two-page letter once; for page printers, we print the letter ten times as a single 20-page document, which reduces the significance of the delay that occurs when the printer produces the first page. Since expensive color printers typically are not used for printing unformatted text, we did not run this test on the printers in our color section.

LOTUS 1-2-3 FOR WINDOWS TEST

One of the new tests in our suite this year is this two-page spreadsheet with embedded graphics, created in Lotus 1-2-3 for Windows. This document shows the printer's performance when producing typical business graphics from within Windows.

sleep mode that meets Energy Star requirements. A power-saving mode isn't that hard to implement, and it will be a requirement for printers sold to the government.

More printers will also include high-speed bidirectional parallel ports. The IEEE 1284 specification combines all the high-speed parallel-port initiatives of the past two years under one compatible master spec. You'll be able to send data to the printer ten or more times faster than you can today, and you'll get far better on-screen status information.

You might also see printers with inexpensive infrared receivers built in—a technology pioneered by HP. Building them in costs only a few dollars.

ABOUT THE ISSUE

To be included in this issue, printers had to be new since our 1992 blockbuster (November 24, 1992). We also brought back several of last year's Editors' Choice picks, most notably the HP LaserJet 4M, to see how they stacked up against the 1993 contenders. Since we reviewed new battery-powered portable printers recently in a special portable computing issue (August 1993), they're not covered here.

The review sections are arranged in this order:

- Thirty-seven mainstream laser and LED page printers (rated for less than 12 ppm). Throughout this issue, when we say *laser*, we use it in the colloquial sense that most users do, regardless of the technology under the hood.
- Thirteen shared, or networkable, laser printers (rated for 12 ppm and up).
- Ten high-quality color printers.
- Six ink jet printers, including one that prints capably in color: the DeskJet 550C.
- Thirty-five dot matrix printers, ranging from affordable personal printers to heavy-duty forms printers.

Within each section, reviews are arranged alphabetically by vendor name. Multiple printers from the same vendor appear under a single heading, although we always test printers individually. Essentially identical models from different vendors are reviewed together and appear under the name of the vendor that is first alphabetically. □

INTRODUCING THE ONLY ANTIVIRUS SOFTWARE THAT WON'T BE OBSOLETE BY THE TIME YOU FINISH READING THIS AD.



The Brachiosaurus.
Was it a giant meteor? Global cooling?
Who knows what finished this guy off. In
any case, he was positively passé by the
end of the Mesozoic era.



The Ford Edsel.
"Out" even before it was "in."
Apparently, the saying that everyone
enjoys 15 minutes of fame doesn't
apply to the automobile kingdom.



Typical Antivirus Software.
Needs to be updated every month.
Useless against the three new viruses
coming out each day. Almost as
technologically advanced as a Slinky.

It's called Norton AntiVirus™ 3.0 (NAV) for Windows and DOS. It has a brand new Windows interface that makes it easier to use and configure. And it makes other antivirus software look as up-to-date as the leisure suit.

That's because it fights both known viruses and new ones that come out every day. So you don't need to keep raiding your wallet to update your protection, something you'd have to do with other products.

Here's how NAV works. First, it scans your files for known viruses - it recognizes over 2,000 of them. Once discovered, they're automatically eliminated from your system.

Next, NAV takes care of unknown viruses, something that most other software can't do. Using our patent-pending Symantec Novi Virus Sensor Technology, NAV runs rule-based integrity checks to compare current file characteristics with a snapshot stored in RAM before the program is executed. When it notices viral activity, it instantly kills it. NAV also repairs damaged file areas before the virus can complete its dirty work.

For even further protection, NAV

alerts you to changes being made to your files — by some anonymous virus, for example. Bad news for even the most clever viral code.

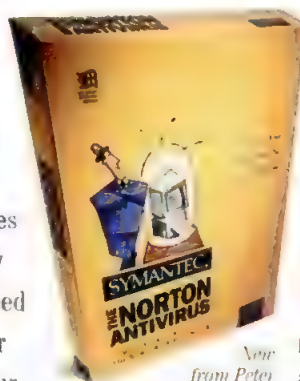
And because NAV scans for viruses faster than any other software, you'll never feel tempted to deactivate the scan to avoid waiting. Plus, you can schedule automatic scans for times when you're not using your computer.

NAV also comes with a network installer* for remote installation, requires very little memory space, and is even available to you in a Network Loadable Module (NLM) version.

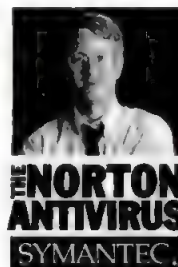
As if all this weren't enough, NAV is both a PC World Best Buy and a PC Magazine Editor's Choice for March '93. So there you have it.

If you'd like more information (via fax) about the only product that can offer you total, up-to-the-minute antivirus protection, please dial 1-800-554-4403, select option 1 and request document 449. Then go ahead and put that other antivirus software where it belongs.

Upstairs in the attic with your prized collection of disco records.



*New
from Peter
Norton, the biggest
name in virus protection.*



Mainstream Lasers *Improving on Strengths*



Lasers have broken the \$500 mark, but low price isn't the only appeal of these 37 printers. Better output quality, plenty of performance levels, energy-saving features, and unobtrusive design are just as welcome.

The big news in mainstream lasers this year is savings—not just in terms of purchase price, but in terms of toner, paper, electrical power, and even user time and effort. As we approach the inevitable limit of what manufacturers can afford to charge for 15 to 55 pounds of high-tech stuff, vendors are seeking a competitive edge by cramming more efficiency and ease of use into the same-size package, making their printers even more valuable.

The most apparent evidence of cost-cutting is the list prices of this year's crop of printers. For the first time, we saw laser printers with street prices below \$500.

There are six units here with list prices below \$800, led by the Sharp JX-9400 (\$599) and Okidata OL400e (\$699). The Panasonic SideWriter KX-P4400, which wasn't shipping in time for testing, is a \$649 PCL-only version of the reviewed Panasonic SideWriter KX-P5400.

This is also the first year we saw true Adobe PostScript Level 2 in a printer listing below \$1,000. Both the DEClaser 1152 (\$999) and SideWriter KX-P5400 (\$999), reviewed here, offer this feature.

There's more to the story than low prices, however. Low-speed (4-, 5-, and 6-page-per-minute) printers are taking over the marketplace. According to an

by Alfred Poor

Mainstream Lasers

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analyst from BIS Strategic Decisions, more lasers in the 6-ppm-and-below range sold last year than the traditional 7- to 11-ppm models. And though sales of midspeed machines are projected to remain fairly flat, the number of low-speed lasers sold is expected to rise by more than 50 percent in the next five years.

One reason for this rapid growth at the low end is that people are possessive about their printers. They would rather have a slower printer on their desks than shared access to a faster one down the hall. Since these new prices make it possible to buy as many as five or more personal printers for the price of one shared printer, there isn't that much more cost involved in giving more people their own private printers.

Another factor is the rapid growth in the small-office/home-office market. According to Charles Gunderson, director of imaging product management for Epson America, that market is accounting for the majority of 4- to 6-ppm laser printer sales, and the needs of users in small offices have a major impact on the direction of product development efforts.

Whatever the reason, there are increasingly more low-speed printers to consider. This Mainstream Laser section covers any printer that is capable of up to 11 ppm, but out of the field of 37 machines reviewed here, 21 have engine speeds of 4, 5, or 6 ppm.

MORE FOR LESS

Since falling prices tend to make price differentials smaller, vendors have been looking for ways to make their products stand out. One way is to simply add features. For example, of the 36 printers here that offer support for PCL (the HP LaserJet page description language), 16 support the more powerful and flexible PCL 5 version of the language. Of the 22 printers that come standard with PostScript or one of its clones, 10 support the more capable and faster Level 2 version of Adobe PostScript.

Nineteen of the 37 printers here offer resolution that is better than 300 dots per inch, either through higher engine resolution, enhanced image resolution, or a combination of both. Four of the printers we look at even claim 1,200-dpi resolution.

Memory and processing power are also differentiating features. Fifteen of the 37 printers that are reviewed here come with 4MB or more of memory. Twenty of them are powered by RISC processors for added performance; members of the AMD Am29200 family and variations of the Intel i80960 chip were tied at six apiece as the most-popular RISC chips. Printers with RISC processors tended to output graphics two to three times faster than those with chips based on CISC technologies.

Four printers here take B-size (11- by 17-inch or tabloid-size) paper and range

in price from \$3,995 to \$7,495. You'll find another four B-size printers in the Network Lasers section of this story.

But if manufacturers appear to be concerned about giving customers more printer for the money, they also seem to be concerned about providing a printer that can continue to create savings after the initial purchase, either by offering duplexing capabilities or reducing per-page and energy costs.

Duplexing lets you print on both sides of a sheet of paper. A typical page of laser-printed output costs about 2 to 3 cents, plus 1 cent for the cost of the paper itself. By reducing the number of sheets used, duplexing can mean significant savings. Duplexing options are most often found in faster, network-oriented laser printers, but Lexmark International's IBM 4039 10R and IBM 4039 10R Duplex, reviewed here, also offer such features.

Another area where printers are being designed to save money is energy conservation. The Environmental Protection Agency's new Energy Star program requires that qualifying printers rated at less than 15 ppm draw less than 30 watts of power when they are in their power-conserving mode. Thirteen of the 37 printers in this roundup have power-saving modes, and our tests show that all of those conform to the Energy Star requirements. In general, these printers use between 3 percent and 10 percent of the electricity in power-saving mode they would use when they are actually printing. Compared with normal idle power consumption, the power-saving modes typically use between a quarter and a third as much power.

Designers have been searching for other ways to create savings for users. Special photoconductor print drums have exceptionally long lifetimes, lowering the per-page cost for consumables. The leaders in this area are the Kyocera Ecosys a-Si series printers, which feature drums and photoconductors that are rated for 20 years of use, resulting in a per-page printing cost of 0.8 cents. (Kyocera's only new model this year is the 18-ppm Kyocera Ecosys a-Si Printer FS-3500A, reviewed in the Network Lasers section of this story.)

Hewlett-Packard Corp. has taken an-

Mainstream Lasers

other approach to lowering consumable costs by putting less toner on the page. The new HP LaserJet 4L, HP LaserJet 4ML, HP LaserJet 4P, and HP LaserJet 4MP have draft modes that print every other dot in each direction, cutting the amount of toner used in half. The output looks gray instead of black but is still completely legible.

Some manufacturers have also taught their printers to do more with less. For example, new members of the HP LaserJet 4 family (the 4L, 4P, 4ML, and 4MP) use a memory-enhancement technology that compresses text and images so that most full-page images can fit even in 1MB of memory.

Another way to save users' money is to build more functionality into the printer. Only two of the printers here—the Brother Laser Printer HL-10h and the Panasonic SideWriter KX-P5400—offer a fax modem as an option, but it's a safe bet that you're going to see a lot more printers that can also handle tasks such as scanning documents or sending and receiving faxes. Two examples are the Okidata Doc-It 3000 (300 dpi, \$3,299) and Doc-It 4000 (400-dpi, \$3,799).

TIME IS OF THE ESSENCE

A printer can save time as well as money, and vendors have been seeking ways to

do both. This may seem a paradoxical goal for a slow printer, but it actually makes a lot of sense. For example, large graphics files often take a similar length of time to print, no matter what printer you use. The rate-determining factor is not the speed of the engine, but the length of time it takes to transmit the image data from the computer to the printer. To a lesser degree, the speed of the printer's controller also plays a part.

There are many ways manufacturers have tried to cut the time required to print large graphics images. HP's Bi-Tronics high-speed parallel port is one example. PCL 5 and PostScript Level 2 offer significant time savings in that they can compress bitmapped data into smaller data streams than their preceding versions. And RISC processors can significantly speed the time it takes to process complex graphics.

Perhaps the biggest time savers are features that make printers easier to configure and use. Many printers have streamlined user interfaces; some, like the LaserJet 4L, have dumped their control panels almost entirely and rely on their intelligence and the software in your computer to handle configuration changes and print job management.

Automatic port switching, available on 28 printers in this roundup (see Sum-

mary of Features), saves time by letting two users—or more, in some cases—hook their computers directly to a printer without having to worry about front panel controls when sending print jobs. Many printers go a step farther to provide simultaneously active ports, which can receive information at the same time, spooling it to memory until it is ready to be processed and printed. Even better is automatic emulation switching, which lets a printer inspect the incoming data stream and decide which printer language (such as PCL or PostScript) it contains.

REVIEW CRITERIA

To make it into this section, a printer had to print at up to 11 ppm using laser or LED technology. It also needed to have been introduced since last year's annual Printer issue (November 24, 1992) and shipping by late July 1993. As comparison points for this year's crop, we also brought back the HP LaserJet 4M—one of last year's Editor's Choice winners. (And it turns out that a year has done little to diminish its appeal.)

We received 37 printers from 19 vendors: Apple Computer, Brother International Corp., Citizen America Corp., Digital Equipment Corp., Epson America, Hewlett-Packard Co., LaserMaster

HIGHLIGHTS**Mainstream Laser Printers**

\$500 LASER PRINTERS are the big news this year. Two of the products in this roundup have list prices of about \$700 and commonly sell for under \$500. They skimp on memory and lack desirable features such as resolution enhancement, but they are adequate for standalone desktop use—especially in text-heavy applications.

THE HP LASERJET 4L sets the pace for basic personal laser printers. With resolution-enhanced 300-dot-per-inch output, 4-page-per-minute performance, power-saver and draft-output modes, and other notable features, the LaserJet 4L (\$849) typically sells for about \$650 on the street. The HP

LaserJet 4P (\$1,229) offers similar capabilities, but it bumps resolution up to 600 dpi—all for just over \$1,000 on the street.

LOW-COST POSTSCRIPT printers offer Adobe PostScript or various clones for list prices below \$1,000. One, the TI microWriter, sells for under \$700 on the street. With the advent of TrueType, PostScript is less significant than it used to be for many applications. But if you still need the capability, you can get it for less money than ever before.

600-DPI ENGINES are gaining in popularity and coming down in price. Nine-

teen of these reviewed printers offer output at 600 dpi or better, but many run at their full resolution only in PostScript, reverting to 300 dpi under PCL emulation.

ERGONOMICS AND ENVIRONMENTAL considerations are reshaping the laser printer's physical form. The vertical-standing Panasonic SideWriter KX-P5400 (\$999), for example, has a tiny 4.75- by 15-inch footprint. Meanwhile, power-saving modes are growing in popularity and are found in 13 of the printers we profile here. Two of HP's models use so little power when resting that they eliminate on/off switches entirely.

Mainstream Lasers



Corp., Lexmark International, NEC Technologies, NewGen Systems Corp., Okidata, Panasonic Communications & Systems Co., QMS, Samsung Electronics America, Sharp Electronics Corp., Star Micronics America, Tandy/Radio Shack Corp., Texas Instruments, and Xante Corp.

The Sharp JX-9460 PS and JX-9660 PS (prices to be determined), IBM LP 4037 5E (\$799), and SideWriter KX-P4400 (\$649) were not shipping in time for us to test. Additionally, 8 manufacturers missed our deadlines or opted not to send the following products: Dataproducts LZR885 (\$1,395), GCC Eclipse (\$1,799), GCC SelectPress 600 (\$4,499), Konica LP3210PS (\$2,295), LaserMaster Win-Printer 600XL (\$2,495), NEC Silentwriter 1097 (\$1,500), Panasonic KX-P5410 (\$1,399), Samsung Protege 5000 (\$1,295), and XLI Image Xpert 5000 (\$5,995).

Even without those products we were unable to review, this roundup offers you a look at a full field with more diversity than we have ever before presented in a Mainstream Laser section. From support for 11- by 17-inch paper to typesetter-quality output, from bargain-basement list prices to comprehensive lists of standard and optional equipment, and from 15-pound bantams to 55-pound heavyweights, these 37 mainstream laser printers offer something for everyone—at savings every user will appreciate.

Apple Computer Inc.

Apple LaserWriter Pro 600

Apple LaserWriter Pro 630

Apple LaserWriter Select 310

BY TED NEEDLEMAN

Apple Computer's newest LaserWriter models work with PCs much less reluctantly than did the older breed. Two 8-page-per-minute, 600-dot-per-inch products, the Apple LaserWriter Pro 600 (\$2,099) and Apple LaserWriter Pro 630 (\$2,529), provide HP PCL 4 emulation, in addition to true Adobe PostScript Level 2 support, and offer good connectivity as well. For the low-cost PostScript market, Apple Computer now sells the

EDITORS' CHOICE

- *Low-Cost (PCL only)* **Okidata OL400e**
- *Low-Cost (PostScript)* **TI microWriter**
- *General-Purpose (PCL only)* **HP LaserJet 4L, HP LaserJet 4P**
- *General-Purpose (PostScript)* **HP LaserJet 4M, TI microLaser Pro 600**
- *B-Size Output* **QMS 860 Print System**

In the past year, mainstream laser printers have improved in almost every way imaginable, offering—among other things—speedier performance, crisper output, lower energy consumption, smaller footprints, and PostScript Level 2 support. The 37 printers

here offer resolutions from 300 to 1,200 dots per inch and performance from 4 to 10 pages per minute. If you're seeking something even faster, or if you demand extremely versatile paper handling, turn to the Network Lasers section of this story for more choices.

BREAKING \$500

The real excitement in laser printers this year is price. The Okidata OL400e (\$699), for example, brings basic laser printing to your desktop for a shade under \$500 on the street. It includes only 512K of memory and doesn't offer any form of resolution enhancement, but if you want laser quality, you won't find

a better bargain. The OL400e doesn't skimp on performance either: During testing, it beat many of the more expensive models with 4-ppm engines.

And if your tastes run to PostScript, consider the TI microWriter (\$799), which offers a true Adobe PostScript interpreter and will most likely sell on the street for about \$700—just a bit more than comparable printers without PostScript support. This unit (with 2MB of RAM) turned in respectable test scores and produced acceptable output.

GENERAL-PURPOSE WINNERS

Hewlett-Packard Co. stayed a step ahead of the competition this year with

5-ppm Apple LaserWriter Select 310 for \$1,079.

Apple Computer positions the Apple LaserWriter Pro series as workgroup machines, and hooking either model up to a mixed network of PCs and Macs was an easy task. The Apple LaserWriter Pro 600 and Apple LaserWriter Pro 630 are nearly identical: Both are based on a 600-dpi Canon EX engine and come standard with 8MB of RAM (expandable to 32MB). Both also include LocalTalk, parallel, and serial ports; the LaserWriter Pro 630 adds an Ethernet port and two SCSI ports for connecting hard disks. With separate software, the printers can autoswitch from one port to another as they become active.

Both LaserWriter Pro models include Apple's PhotoGrade enhanced-gray-scale technology, which dramatically improves halftone clarity by providing 61 discrete gray levels. Halftone quality was noticeably better than for most lasers, though not quite of continuous-tone quality.

The Apple LaserWriter Pro models' performance in PostScript mode was strong; under PCL, however, performance fell sharply. In PCL graphics, performance results were among the lowest of the tested printers.

The Apple LaserWriter Select 310 is a PostScript printer with a compelling price. But to reach that point, Apple had to make some concessions. One is speed,

two pairs of printers that offer a variety of new features. Among them are power-saving rest modes, toner-conserving draft modes, and memory-enhancement technology that improves handling of complex PCL graphics in limited RAM. Enhanced status reporting indicates job progress and the precise location of paper jams, all from the console of your PC—a capability found in Microsoft's Windows Printing System cartridge for the HP LaserJet II and 3 series.

The best bargains among HP's new printers are the 300-dpi HP LaserJet 4L (\$849) and 600-dpi HP LaserJet 4P (\$1,229), both PCL-only 4-ppm models with Resolution Enhancement Technology. The HP LaserJet 4M (\$2,399) is a repeat Editors' Choice winner from last year, again distinguishing itself with impressive 8-ppm performance, resolution-enhanced 600-dpi output, and an Adobe PostScript Level 2 interpreter. The PCL-only HP LaserJet 4, also an Editors' Choice pick last year, is still available, now priced at \$1,759.

An alternative to the LaserJet 4M is the TI microLaser Pro 600 (\$1,599) from Texas Instruments. This unit doesn't offer all the features of the LaserJet 4M; it prints at 600 dpi only in PostScript emulation, doesn't offer resolution enhancement, and includes fewer standard fonts. Moreover, its performance isn't as

strong. But it does produce superb output, and it sells for nearly \$1,000 less than the HP unit.

TABLOID-SIZE OUTPUT

Laser printers capable of producing 11-by-17-inch output have always commanded a substantial price premium, and that's not likely to change anytime soon. For a street price below \$4,000, though, the QMS 860 Print System offers plenty to like: an 8-ppm engine, 600-dpi output, and QMS's own PostScript Level 2 clone. The QMS 860 had the best output and fastest overall performance among the four B-size printers we tested.

B-size printing capability is more common among higher-speed printers. For more choices in this area, turn to our Network Lasers section. Four of the 13 printers reviewed there can print on 11-by-17-inch stock.

HONORABLE MENTION

Laser printers have diversified remarkably in the past year, leaving plenty of room for differentiation. A number of the units we saw offered unusual capabilities that earn them honorable mention. But these units didn't offer the strength demonstrated by the winners.

The Panasonic SideWriter KX-P5400 stands out from the pack—literally. This \$999 marvel actually sits up-

right, giving it a tiny 4.75- by 15-inch footprint. It offers true Adobe PostScript Level 2 support in addition to PCL 5 emulation. Its performance was unexceptional (even when compared with other 4-ppm printers), but it's a natural choice for use beside your PC.

The Sharp JX-9400 (\$695) was the only 6-ppm laser printer tested that can compete on price with low-end 4-ppm products. But though its text performance was stronger than other printers in its price range, its graphics performance lagged behind.

The IBM 4039 10R Duplex is a 10-ppm printer that can print on both sides of a page. It offers Lexmark's PostScript emulation, delivers top performance, and features the easiest-to-use control panel around. With a street price below \$2,000, it's also one of the least expensive ways to generate two-sided output.

The HP LaserJet 4ML (\$1,279) and HP LaserJet 4MP (\$1,729) are PostScript-enhanced versions of the LaserJet 4L and LaserJet 4P, respectively. With their somewhat high list prices, the LaserJet 4ML and LaserJet 4MP can't compete on price with the TI microWriter and TI microLaser Pro 600. But they're extremely capable printers, and if you're willing to spend a few hundred dollars extra for their additional features (and venerable HP name) you won't be disappointed.

particularly when printing graphics: The LaserWriter Select 310 achieved only 0.6 gppm (graphics pages per minute) on our Graphics Speed test.

The LaserWriter Select 310 offers a Centronics parallel interface in addition to the LocalTalk interface. Unlike the LaserWriter Pro models, though, the LaserWriter Select 310 does not provide PCL support—nor does it offer PostScript Level 2. During testing, we noted that the text portion of a mixed-text-and-graphics page evidenced improper kerning.

Apple also provides fewer fonts than usual in a Post-

Script machine, offering only 13 variations on four typefaces: Courier, Helvetica, Times, and Symbol. The printer's 1.5MB of RAM is minimal for PostScript duty, but it can be expanded to 5.5MB.

Street prices for Apple Computer's printers vary, depending on what sort of deal you can strike with resellers. If bargain-priced PostScript printing is a priority, the Apple LaserWriter Select 310 is worth considering. For a mixed PC/Macintosh environment where high-quality PostScript output is a priority, the Apple LaserWriter Pro 600 and the Apple LaserWriter Pro 630 are solid choices.

Apple Computer Inc., 20525 Mariani Ave. Cupertino, CA 95014; 800-776-2333; fax, 800-462-4396.





Small Footprint.



THE NEW SIDEWRITER PRINTERS FROM PANASONIC.

You're looking at the most extraordinary feat in laser-quality printing today. The feature-rich Panasonic® SideWriter LED printers deliver everything you're looking for in a printer, within a footprint that's smaller than an 8-1/2" x 11" sheet of paper. ♦ Obviously, these printers will fit neatly just about anyplace in your office or home. And at a little over 14 pounds, they are

SideWriter



Gigantic Feat.



the lightest and smallest laser-quality printers in their class. ♦ The KX-P4400 is PCL4 compatible, and delivers laser-quality printouts at four pages per-minute. It has an SRP of \$649. ♦ If you could use optional fax capability, PostScript Level 2, and more, pick up the KX-P5400 at an SRP of just \$999. ♦ Either way, you'll start performing your own gigantic feats. ♦ Call 1-800-742-8086 for the dealer nearest you.

Panasonic
Office Automation 

CIRCLE 122 ON READER SERVICE CARD

Benchmark Tests: Laser Printers

The IBM 4039 10R and IBM 4039 10R Duplex had the best performance in HP PCL emulation, thanks to their fast, 10-page-per-minute engines. Overhead introduced by the duplexer is evident in the latter model's comparatively lower Text Speed scores. The 8-ppm HP LaserJet 4M was consistently among the leaders in both HP PCL and PostScript emulations, though on some of our PostScript-mode tests it was edged out by the TI microLaser Pro 600. The fastest PostScript graphics performers were the HP LaserJet 4M, the LaserMaster Unity 1200XL-O Plain-Paper Typesetter, and the Texas Instruments MicroLaser Pro 600, all of which are based

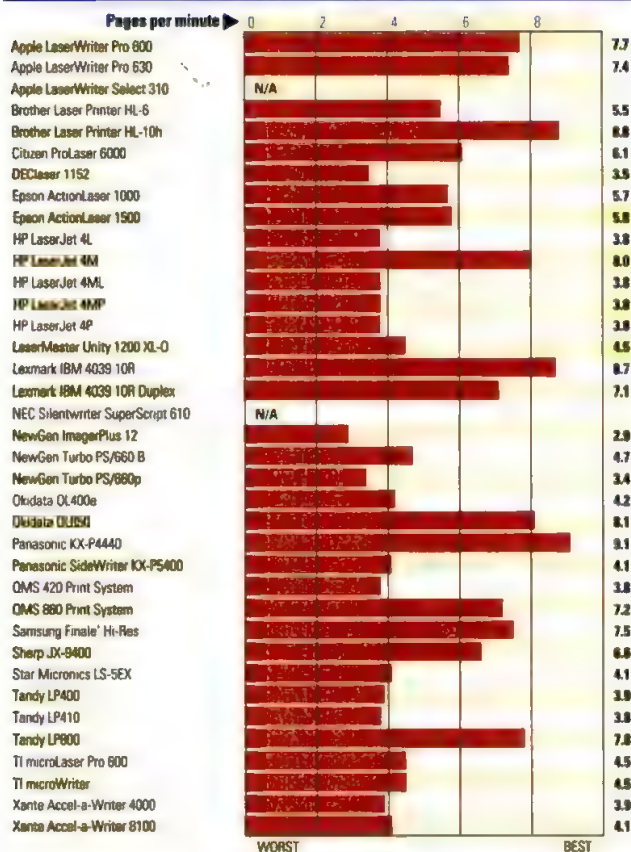
on fast RISC processors. The slowest PostScript graphics performer was the DEC Laser 1152.

The HP LaserJet 4L, HP LaserJet 4ML, HP LaserJet 4MP, and HP LaserJet 4P models used the least amount of energy by far when idle and when in power-saver mode. The DEC Laser 1152 and the Apple LaserWriter Select 310 used the least power while printing.

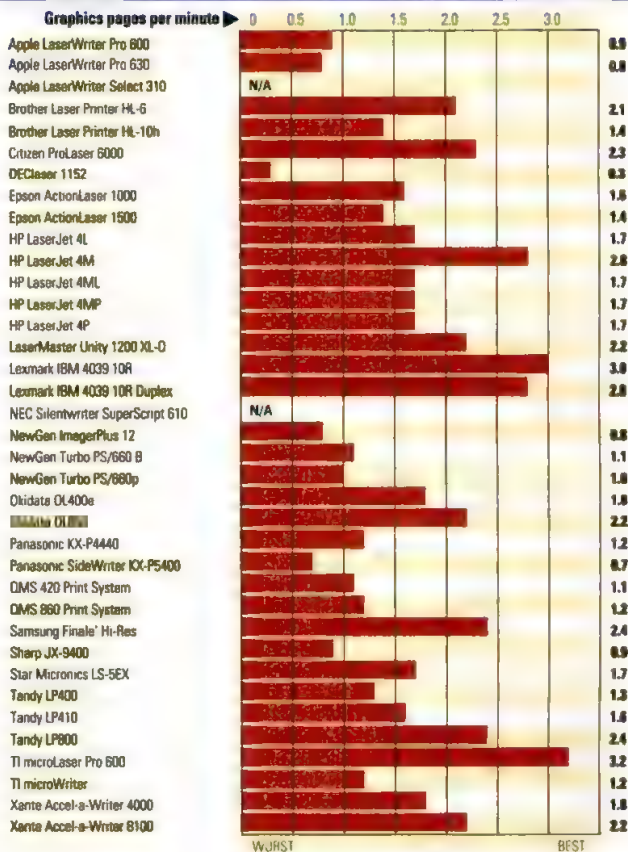
Using the parallel port, we performed each speed test in HP PCL mode and again in PostScript mode (for those printers that support it).

The **Text Speed** test measures the printer's speed in producing ten copies of a two-page business letter with 1-inch margins. A graphics print file was sent directly to the parallel port from DOS.

TEXT SPEED (PCL)



GRAPHICS SPEED (PCL)



N/A—Not applicable. The printer does not support this emulation.

The **Graphics Speed** test measures the printer's speed in producing two copies of a complex single-page graphic containing a TIFF image, horizontal and vertical gray scales, and line art.

The **Word for Windows** test measures the printer's speed in producing a ten-page report that uses multiple fonts and type styles. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **CorelDRAW** test measures the printer's speed in producing a single-page CorelDRAW graphic that contains a TIFF image, horizontal and vertical gray scales, and line art. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **Lotus 1-2-3 for Windows** test measures the printer's speed in producing a complex two-page spreadsheet that contains pie, bar, and line charts. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

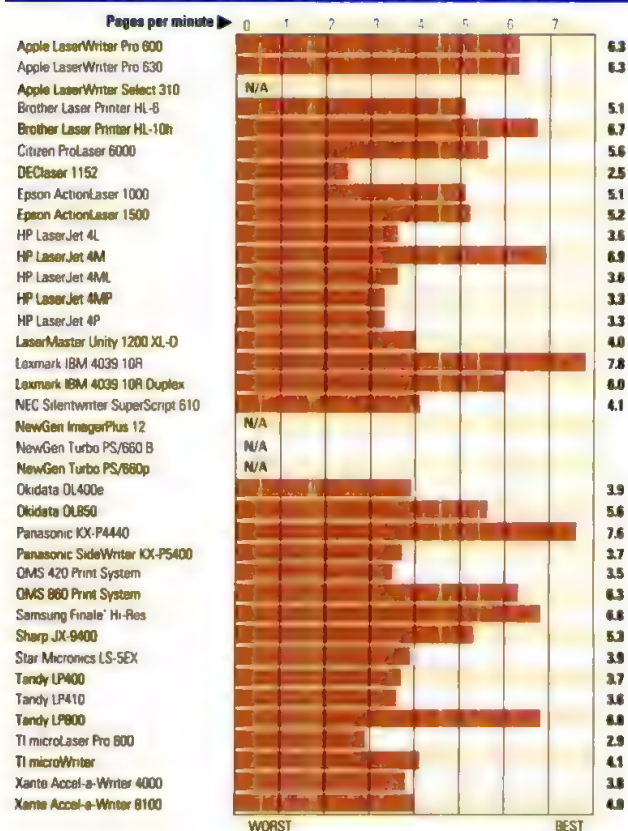
The **Power Consumption** test measures the printer's energy usage under three conditions: when printing, when idle, and when in power-saver mode (sleep mode), where available. For this test only, lower scores indicate better results.

POWER CONSUMPTION

	Power consumption when printing (watts)	Power consumption at rest (watts)	Power consumption in power-saver mode (watts)
Apple LaserWriter Pro 600	151	56	N/A*
Apple LaserWriter Pro 630	188	68	N/A*
Apple LaserWriter Select 310	95	37	N/A*
Brother Laser Printer HL-6	162	63	20
Brother Laser Printer HL-10h	169	36	10
Citizen ProLaser 6000	186	57	N/A*
DEC Laser 1152	90	29	N/A*
Epson ActionLaser 1000	178	57	12
Epson ActionLaser 1500	192	54	N/A*
HP LaserJet 4L	142	5	4
HP LaserJet 4M	178	71	N/A*
HP LaserJet 4ML	175	6	6
HP LaserJet 4MP	182	9	N/A*
HP LaserJet 4P	181	8	N/A*
LaserMaster Unity 1200 XL-Q	178	49	N/A*
Lexmark IBM 4039 10R	242	58	21
Lexmark IBM 4039 10R Duplex	237	49	20
NEC Silentwriter SuperScript 610	162	64	16
NewGen ImagerPlus 12	143	56	N/A*
NewGen Turbo PS/660 B	156	63	N/A*
NewGen Turbo PS/660p	106	38	N/A*
Okidata OL400e	122	42	10
Okidata OL850	187	57	N/A*
Panasonic KX-P4440	222	86	19
Panasonic SideWriter KX-P5400	108	44	11
QMS 420 Print System	131	48	N/A*
QMS 860 Print System	219	82	N/A*
Samsung Finale Hi-Res	250	105	N/A*
Sharp JX-9400	156	46	11
Star Micronics LS-5EX	116	40	N/A*
Tandy LP400	168	48	N/A*
Tandy LP410	158	52	N/A*
Tandy LP800	234	58	N/A*
TI microLaser Pro 600	143	47	23
TI microWriter	158	55	N/A*
Xante Accel-a-Writer 4000	142	48	N/A*
Xante Accel-a-Writer 8100	208	85	N/A*

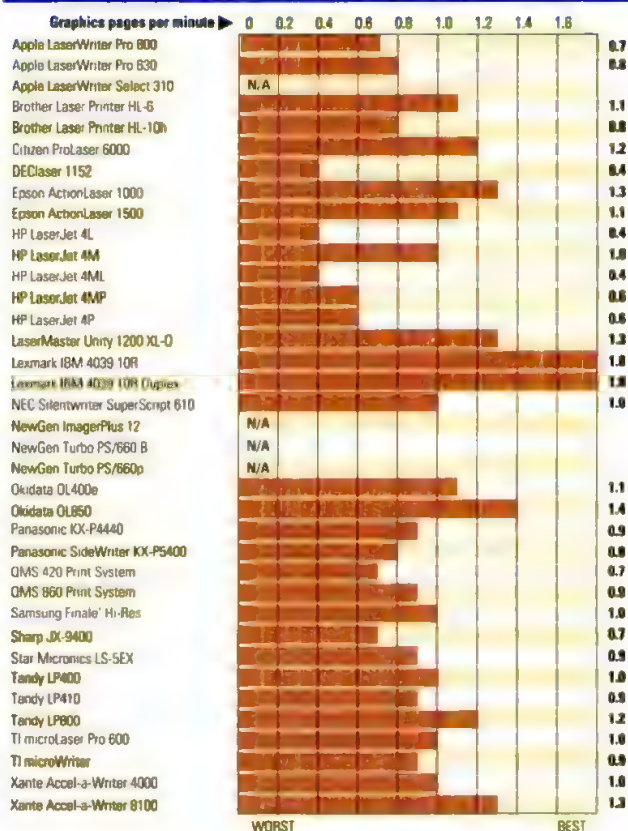
N/A*—Not applicable. The product has no power-saver mode.

WORD FOR WINDOWS (PCL)

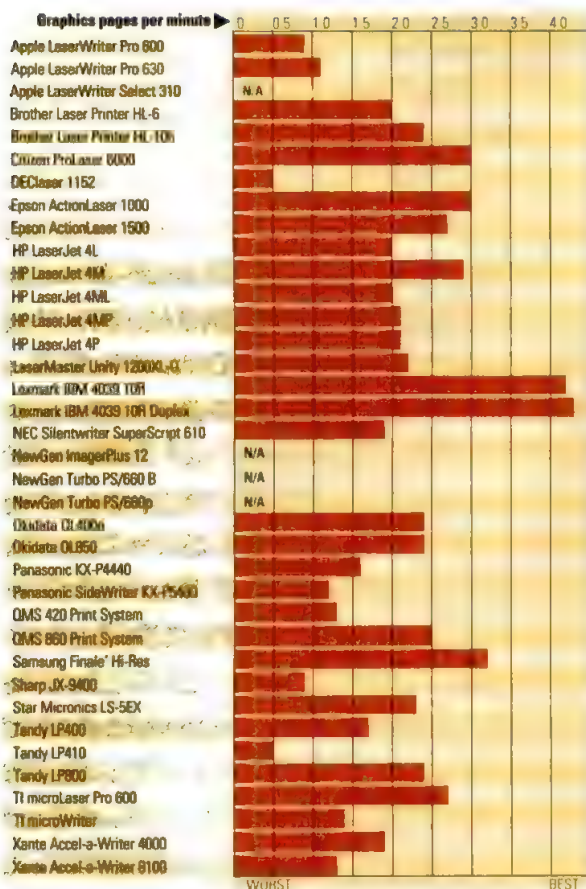


N/A—Not applicable. The printer does not support this emulation.

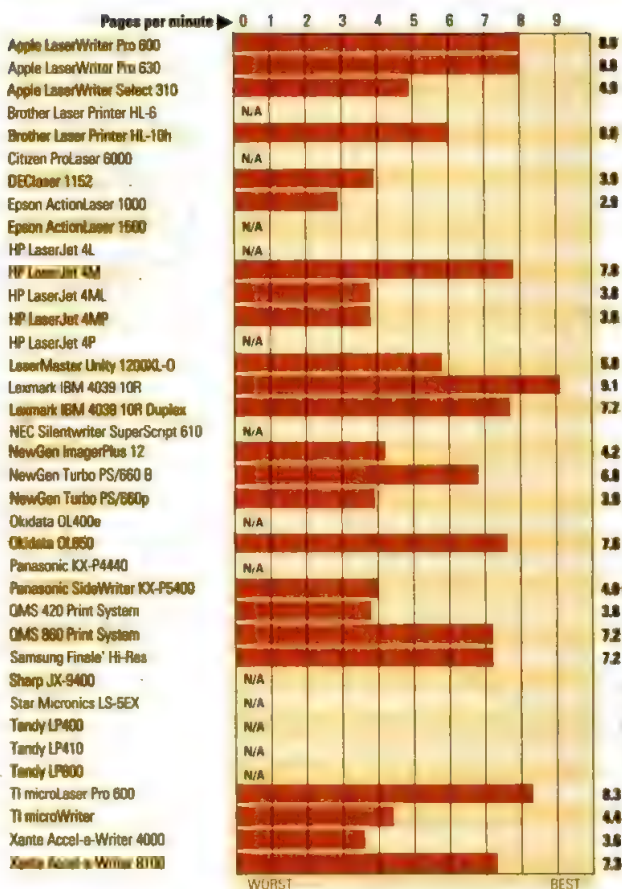
CORELDraw (PCL)



LOTUS 1-2-3 FOR WINDOWS (PCL)



TEXT SPEED (POSTSCRIPT)



N/A—Not applicable: The printer does not support this emulation.

Apple LaserWriter Pro 600 List price: \$2,099; 4MB RAM upgrade, \$269; 500-sheet universal (legal, letter, A4, B4) tray, \$149; 500-sheet universal feeder, \$399; 75-envelope feeder, \$399; toner/developer/drum unit, \$149. Emulations: Adobe PostScript Level 2, HP PCL 4.

Apple LaserWriter Pro 630 List price: \$2,529; options, same as LaserWriter Pro 600. Emulations: Adobe PostScript Level 2, HP PCL 4.

Apple LaserWriter Select 310 List price: \$1,079; 1MB RAM upgrade, \$89; 4MB RAM upgrade, \$269; 30-envelope tray, \$89; 50-sheet/5-envelope multipurpose paper tray, \$25; 500-sheet paper tray, \$299; 250-sheet legal tray, \$79; toner/developer/drum unit, \$89. Emulations: Adobe PostScript Level 1. Circle 470 on reader service card

Brother International Corp.

Brother Laser Printer HL-6 Brother Laser Printer HL-10h

BY BRAD STILWELL

Brother International Corp.'s \$895 Brother Laser Printer HL-6 is a basic 300-dot-per-inch personal printer with a faster-than-average 6-page-per-minute engine. The \$1,549 Brother Laser Printer HL-10h offers PostScript compatibility, 600-dpi resolution with resolution enhancement, and a PCMCIA Type I slot that supports a fax upgrade. Both printers are thoughtfully designed: They automatically switch emulations and ports and offer audible alarms making it easy to detect a jam or an empty paper tray.

(The alarms can be disabled.)

The HL-6, which will likely sell for around \$600, lacks any form of resolution enhancement; it reproduced diagonal lines with visibly jagged edges. But the simplicity of the HL-6's design is a plus. Its Brother engine uses a single-toner cartridge that makes installation easy and ink-free, and it has a built-in 150-page paper tray, 512K of RAM (expandable to 4.5MB), 48 bitmapped fonts, and 12 TrueType fonts standard.

The unit we tested, which included 2.5MB of RAM (bringing the printer's list price to \$1,144), delivered strong performance compared with other printers in the same price range.

The HL-10h is a 600-dpi PostScript-compatible printer that should sell on the street at \$1,200 to \$1,300. With 2MB of standard RAM, however, it proved inad-



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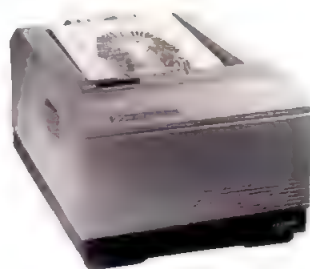
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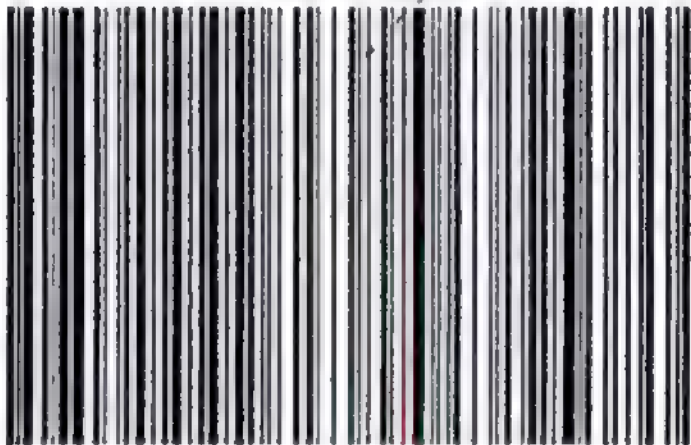


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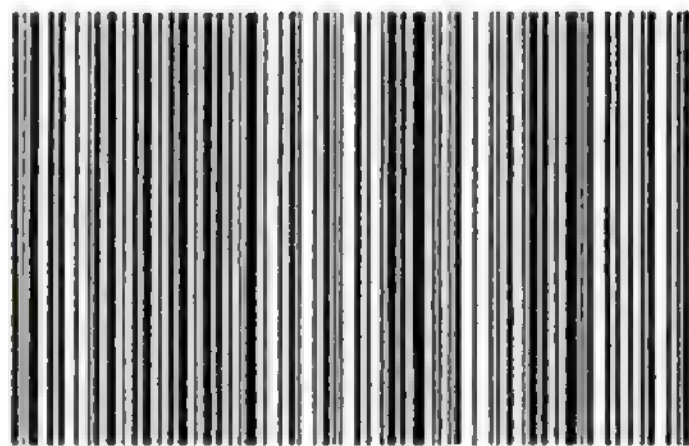
GbpslipBack-0018



Inverted Back

1. Follow instructions on the other side

Folded edge of the page

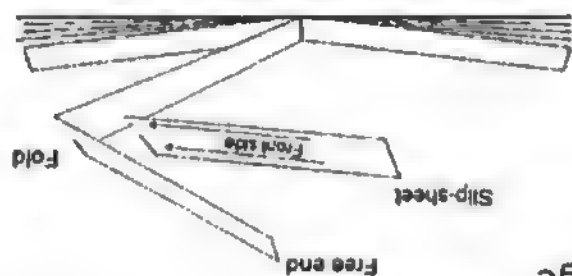
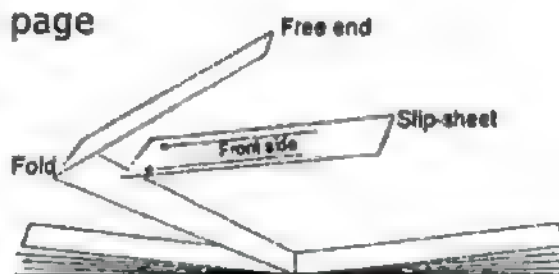


GbsSlipSheet-001

Inverted Foldout slip-sheet

Foldout slip-sheet

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3. Slice the folded edge
4. Close the page and slip-sheet



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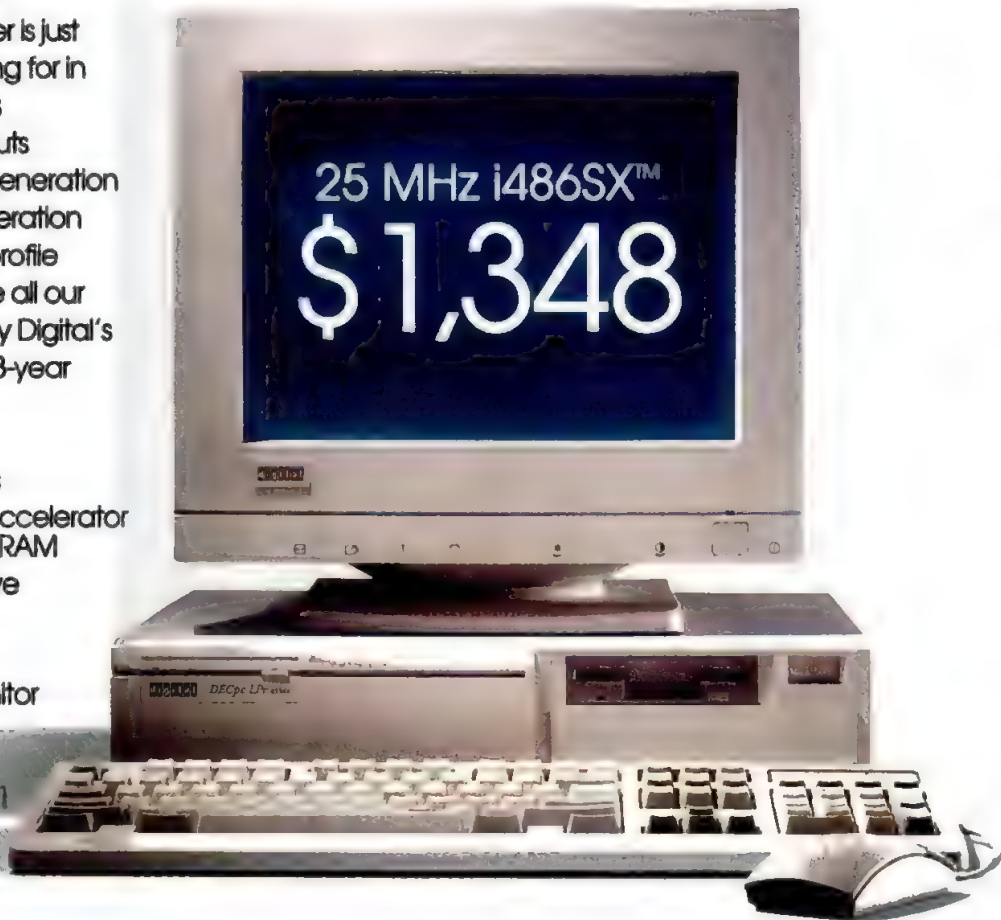


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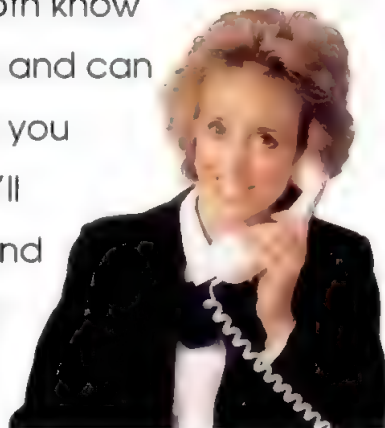
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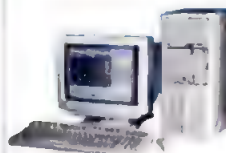
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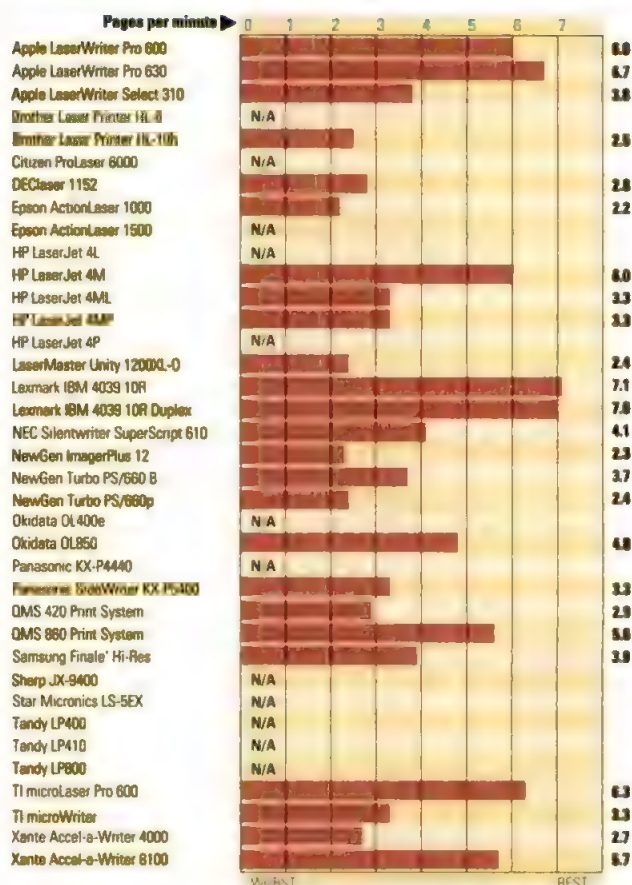
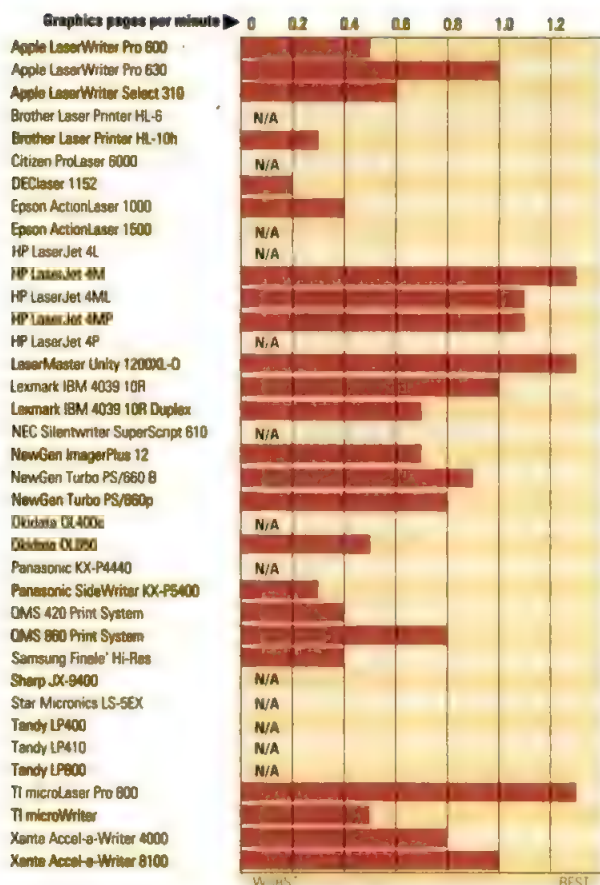
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GRAPHICS SPEED (POSTSCRIPT)

WORD FOR WINDOWS (POSTSCRIPT)



N/A—Not applicable: The printer does not support this emulation

equate for complex graphics. Even after adding 4MB (a \$390 upgrade), our printing in PostScript was agonizingly slow, requiring about 4 minutes per page on 600-dpi graphics. You can expand RAM to 34MB, but for serious PostScript work, a printer based on a RISC processor instead of the HL-10h's 25-MHz Motorola 68030 would likely do better.

Text performance was stronger, and text output quality was good. In our graphics tests, the HL-10h yielded solid blacks and fine gray scales, and its rules and curves were smoothed by its High Resolution Control. The only conspicuous flaw in its graphics printing was some horizontal and vertical banding.

The HL-10h would serve a small workgroup well. Its MIO slot is compatible with third-party network interfaces for HP LaserJet units; Brother also says

it plans to introduce network adapters in the near future. The HL-10h can also accept a fax card in its PCMCIA Type I slot, or it can hook up to a Brother fax machine and act as a plain-paper fax receiver.

Brother International Corp., 200 Cottle Lane, Somerset, NJ 08875-6714; 800-276-7746, 908-356-8880; fax, 908-356-4085.

Brother Laser Printer HL-6 List price: \$895 with 512K RAM (\$1,144 with 2.5MB); 1MB RAM upgrade, \$99; 2MB RAM upgrade, \$249; 4MB RAM upgrade, \$399; 250-

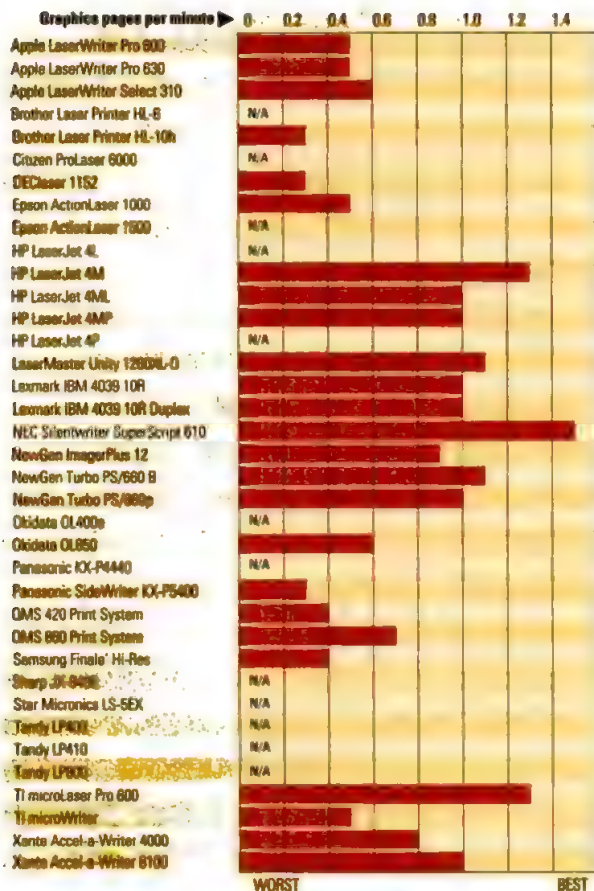
sheet legal-size cassette, \$79; 250-sheet executive-size cassette, \$89; 250-sheet A4-size cassette, \$79; 250-sheet multipurpose cassette, \$209; toner/developer/drum unit, \$95. Emulations: Epson FX, HP PCL 4, IBM Proprinter XL.

Brother Laser Printer HL-10h List



Brother Laser Printer HL-6, Brother Laser Printer HL-10h

CORELDRAW (POSTSCRIPT)



N/A—Not applicable. The printer does not support this emulation.

LOTUS 1-2-3 FOR WINDOWS (POSTSCRIPT)



price: \$1,549 with 2MB RAM; 1MB RAM upgrade, \$98; 2MB RAM upgrade, \$195; 4MB RAM upgrade, \$390; 8MB RAM upgrade, \$695; 250-sheet multipurpose cassette, \$419; toner/developer/drum unit, \$130. Emulations: BR-Script PostScript, Diablo 630, Epson FX, HP PCL 5 enhanced, IBM Proprinter XL. Circle 471 on reader service card

Citizen America Corp.

Citizen ProLaser 6000

BY TED NEEDLEMAN

Built around a 6-page-per-minute Minolta engine, the \$849 Citizen ProLaser 6000 (estimated street price, \$699) ably meets the needs of the entry-level laser market. PCL 5-compatible and standard with 1MB RAM, it expands to 5MB using

standard SIMMs. It also comes with CG Times and Univers (both scalable), Prestige Elite, and the more common Courier and Line Printer typefaces.

Under the front panel is an internal paper tray holding 150 letter- or legal-size sheets. An optional 250-sheet feeder (\$219) that mounts underneath adds 3 inches to height but does not alter the small 14.1-by-17.9-inch footprint.

The 300-dot-per-inch ProLaser 6000 uses a microfine toner and a resolution-enhancement scheme, Fine ART (Advanced Resolution Technology), to cre-

ate crisp, dark type and graphics: only slight banding showed on graphics output and distortion was minimal at low type sizes. Citizen America Corp. claims you

6,000 pages from its combined toner/developer/drum cartridge.

Based on an AMD Am29200 RISC processor, the ProLaser had impressive speed test results, actually beating its rated speed slightly in our

Text Speed test. Graphics speed was also respectable at 2.3 gppm.

Citizen America Corp., 2450 Broadway, P.O. Box 4003, Santa Monica, CA 90411-4003; 800-4-PRINTERS, 310-453-



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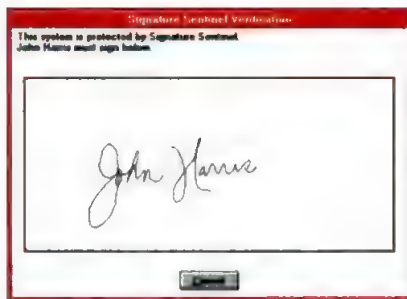
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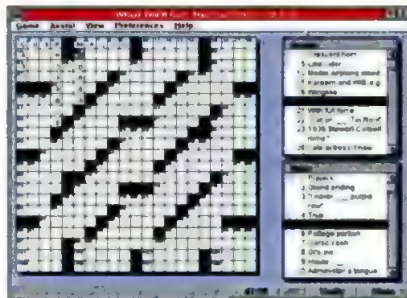
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Mainstream Lasers

0614; fax, 310-453-2814.

Citizen ProLaser 6000 Estimated street price: \$849; 250-sheet letter size cassette, \$219; 20-sheet face-up output tray, \$19; 1MB SIMM, \$149; 4MB SIMM, \$599; toner/developer/drum unit, \$159. Emulations: Epson FX, HP PCL 5, IBM Proprinter.

Circle 472 on reader service card

Digital Equipment Corp.

DEClaser 1152

BY TED NEEDLEMAN

Based on a 4-page-per-minute Canon LX engine, Digital Equipment Corp.'s DEClaser 1152 seems to have it all: a low \$949 list price, Adobe PostScript Level 2 (with 17 fonts) and HP PCL 4, and legendary Digital quality. But with its bottom-of-the-pack graphics performance, this printer is best suited to light-duty personal use.

The DEClaser 1152's graphics speed in PostScript mode was one of the slowest of the laser printers we tested, requiring about four minutes per page of complex graphics. Text speed was good for a 4-ppm printer at 3.5 ppm in PCL mode and 3.9 ppm in PostScript.

The 300-dot-per-inch resolution of the DEClaser 1152 can be enhanced through Digital's proprietary DECimage technology, which comes as a software utility. The company claims the DEClaser's enhanced output is equivalent to 1,000-dpi printing; we found that text was produced cleanly and that graphics evidenced good contrast ratios.

The DEClaser 1152 printer has three interfaces: serial, parallel, and LocalTalk. The DEClaser 1152 can sense which of the ports is active at any given time and switch among them as necessary. It does

not, however, automatically switch between PostScript and PCL 4 printing modes.

The standard fold-down Canon LX engine front-panel paper tray holds only 70 sheets of letter- or legal-size paper, but a 250-sheet-capacity, bottom-mounting sheet feeder is available as an option.

Digital Equipment Corp., 146 Main St., Maynard, MA 01754-2571; 800-344-4825, 508-493-5111; fax, 800-234-2298.

DEClaser 1152 List price: \$949; Adobe Type 2 PostScript font cartridge (26 fonts), \$249; 250-sheet paper cassettes (letter-, legal-, executive-, or A4-size), \$62 each; envelope cassette, \$80; multipurpose cassette, \$99; toner/developer/drum unit, \$79. Emulations: Adobe PostScript level 2, HP PCL 4.

Circle 473 on reader service card

Epson America Inc.

Epson ActionLaser 1000 Epson ActionLaser 1500

BY TED NEEDLEMAN

Priced and positioned to appeal to first-time laser buyers, the ActionLaser series comes with a small booklet entitled "Your First Laser Printer" that is an excellent introduction to the technology.

Both the ActionLaser 1000 and ActionLaser 1500 are based on a Minolta 6-page-per-minute laser engine and powered by a 16-MHz Motorola 68000 CPU. The lower-priced ActionLaser 1000 (\$799 list, \$650 street price) is one of the least expensive 6-ppm laser printers you can buy. Its 512K of RAM can be upgraded to 6.5MB using standard DRAM chips.

With a list price of \$849 and street price of \$680, the ActionLaser 1500 comes with 1MB RAM and takes DRAM chips to expand the RAM up to 5MB. It comes with PCL 5 instead of the ActionLaser 1000's PCL 4 and adds 13 scalable internal fonts to the Courier 10- and 12-



point and EDP 8.5-point line printer fonts both models have.

Both units can take a \$449 PostScript card when 1.5MB or more of RAM is installed. Operation is easy: Once you set the SelecType front panel to recognize the PostScript option, the printer goes from PCL to PostScript automatically.

Setting up both printers was easy, and both delivered close to the rated 6-ppm output speed. Graphics printed at 1.6 graphics pages per minute for the ActionLaser 1000 and 1.4 ppm for the 1500, about average for printers in this class. Epson America includes its own version of resolution enhancement, called RITech, with the ActionLaser 1500, but not the 1000; output quality for both units was crisp and dark with some minor banding showing in our graphics samples.

Both ActionLasers have 150-sheet paper input trays. Epson also offers an optional 250-sheet cassette (\$219).

Epson America Inc., 20770 Madrona Ave., Torrance, CA 90509-2842; 800-289-3776, 310-782-0770; fax, 310-782-4248.

ActionLaser 1000 List price: \$799; 512K RAM upgrade, \$49; 2MB RAM upgrade, \$179; HPGL emulation, \$299; PostScript emulation, \$449; 250-sheet letter-size cassette, \$219; 20-page output tray, \$15; Appletalk interface kit, \$499; twinaxial Ethernet network interface card, \$699; coaxial Ethernet network interface card, \$699; 32K buffer (serial or parallel interface), \$152; toner/developer/drum unit, \$159. Emulations: Epson FX/LQ, HP PCL 4.

ActionLaser 1500 List price: \$849. Options, same as ActionLaser 1000. Emulations: Epson FX/LQ, Epson GL/2, HP PCL 5.

Circle 474 on reader service card



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PRINTERS

Mainstream Lasers

Apple LaserWriter Pro 600

\$2,099

8-ppm laser printer (Canon EX engine) with 600-dpi output, Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 3.5 ppm

PCL Graphics Speed: 0.9 gppm

PCL WINDOWS APPLICATIONS:

Word for Windows: 6.3 ppm

CorelDRAW: 0.7 gppm

Lotus 1-2-3 for Windows: 0.9 gppm

PS Text Speed: 8.0 ppm

PS Graphics Speed: 0.5 gppm

PS WINDOWS APPLICATIONS:

Word for Windows: 6.0 ppm

CorelDRAW: 0.5 gppm

Lotus 1-2-3 for Windows: 3.0 gppm



Avant Garde Palatino
Bookman Σμβολ (Sym)
Courier Times
Helvetica Zapf Chancery
New Centur ❖❖❖❖❖❖❖



Apple LaserWriter Pro 630

\$2,529

8-ppm laser printer (Canon EX engine) with 600-dpi output, Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 7.4 ppm

PCL Graphics Speed: 0.8 gppm

PCL WINDOWS APPLICATIONS:

Word for Windows: 6.3 ppm

CorelDRAW: 0.8 gppm

Lotus 1-2-3 for Windows: 1.1 gppm

PS Text Speed: 8.0 ppm

PS Graphics Speed: 1.0 gppm

PS WINDOWS APPLICATIONS:

Word for Windows: 6.7 ppm

CorelDRAW: 0.5 gppm

Lotus 1-2-3 for Windows: 3.0 gppm



Avant Garde Palatino
Bookman Σμβολ (Sym)
Courier Times
Helvetica Zapf Chancery
New Centur ❖❖❖❖❖❖❖



Apple LaserWriter Select 310

\$1,079

5-ppm laser printer (Fuji Xerox engine) with 300-dpi output, Adobe PostScript

PS Text Speed: 4.9 ppm

PS Graphics Speed: 0.6 gppm

PS WINDOWS APPLICATIONS:

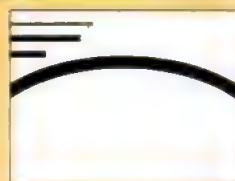
Word for Windows: 3.8 ppm

CorelDRAW: 0.6 gppm

Lotus 1-2-3 for Windows: 2.0 gppm



Courier
Helvetica
Σμβολ (Symbol)
Times



Brother Laser Printer HL-6

\$895

6-ppm laser printer (Brother HL-6 engine) with 300-dpi output, HP PCL 4

PCL Text Speed: 5.5 ppm

PCL Graphics Speed: 2.1 gppm

PCL WINDOWS APPLICATIONS:

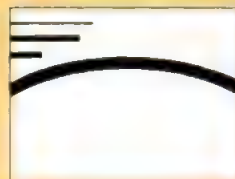
Word for Windows: 5.1 ppm

CorelDRAW: 1.1 gppm

Lotus 1-2-3 for Windows: 2.0 gppm



Brougham
Helsinki
Letter Gothic
Tennessee



Brother Laser Printer HL-10h

\$1,549

10-ppm laser printer (Brother HL-10h engine) with 600-dpi output, BR-Script, enhanced HP PCL 5

PCL Text Speed: 8.8 ppm

PCL Graphics Speed: 1.4 gppm

PCL WINDOWS APPLICATIONS:

Word for Windows: 6.7 ppm

CorelDRAW: 0.8 gppm

Lotus 1-2-3 for Windows: 2.4 gppm

PS Text Speed: 6.0 ppm

PS Graphics Speed: 0.3 gppm

PS WINDOWS APPLICATIONS:

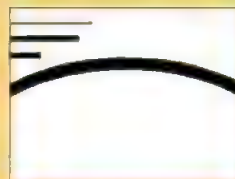
Word for Windows: 2.5 ppm

CorelDRAW: 0.3 gppm

Lotus 1-2-3 for Windows: 2.2 gppm



Letter Gothic
OCR-A Connecticut
OCR-B Guatemala A
Albertville Maryland
Antique Oz Oklahoma
Brougham PC Brussels



AUSTIN has what DELL wants for Christmas.



It's true.

"Dell Computers — and others — had a great idea: produce a compact notebook with blazing speed and a large capacity hard disk.

Sounded good to us. Only difference is, we made it happen! Our Ultimate Notebook features a 66 MHz processor with a 340 MB hard drive — something Dell just cannot seem to deliver.

But the real reason we pushed ahead with this product is because you, our customers, told us that's what you wanted. Maybe unlike some others, when our customers talk, we listen! Hope you enjoy this terrific notebook!"

David Scull, President/CEO
Austin Computer Systems

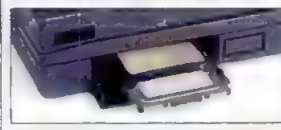


Flexible Display Options. Austin's new Dual Scan color systems deliver bright, vivid color at a cost-effective price. Choose active-matrix color for the most demanding applications, or razor-sharp monochrome when color isn't needed.

Accelerated Video. 32-bit local-bus video accelerator with 1 MB of VRAM — found in the hottest desktops ... and on all Austin Notebooks! Plus, simultaneous CRT and LCD display.

PCMCIA Expandability.

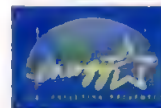
Two PCMCIA slots takes two Type II or one Type I device for fax modems, LAN adapters and more.



Rugged, high-speed glass media hard drives. Choose from 130, 213 or 340 MB — the largest on the market!

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Large ergonomic front-center trackball for exceptional ease of use. No need to fumble with awkward clip-on or pull-out pointing devices.



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32-Bit Local Bus Video Accelerator with 1 MB RAM

	\$1,899	\$2,199	\$2,999	\$4,499
	486SX 25	486SX-25 Dual Scan Color	486DX2 66 Dual Scan Color	486DX2 66 TFT Color
4 MB RAM Standard	4 MB RAM Standard	4 MB RAM Standard	8 MB RAM Standard	8 MB RAM Standard
130 MB Hard Drive	130 MB Hard Drive	213 MB Hard Drive	340 MB Hard Drive	
Memory	40 MB RAM maximum	40 MB RAM maximum	40 MB RAM maximum	40 MB RAM maximum
I/O Ports	1 Parallel, 2 Serial, 1 VGA	1 Parallel, 2 Serial, 1 VGA	1 Parallel, 2 Serial, 1 VGA	1 Parallel, 2 Serial, 1 VGA
Diskette Drive	3.5" 1.44 Mb	3.5" 1.44 Mb	3.5" 1.44 Mb	3.5" 1.44 Mb
Power Usage	4 Watts (with standby monitor)	4 Watts (with standby monitor)	4 Watts (with standby monitor)	4 Watts (with standby monitor)
Battery Life	2.5 hours	2.5 hours	2.5 hours	2.5 hours
Preinstalled Software	MS-DOS 6	MS-DOS 6	MS-DOS 6	MS-DOS 6
Dimensions	11.1" x 8.1" x 1.5"	11.1" x 8.1" x 1.5"	11.1" x 8.1" x 1.5"	11.1" x 8.1" x 1.5"
Weight	6.3 lbs	6.3 lbs	6.3 lbs	6.3 lbs
Warranty	1 year	1 year	1 year	1 year



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CIRCLE 156 ON READER SERVICE CARD

PRINTERS
Mainstream Lasers

Citizen ProLaser 6000

\$849

6-ppm laser printer (Minolta engine) with 300-dpi output, HP PCL 5

PCL Text Speed: 6.1 ppm
PCL Graphics Speed: 2.3 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 5.6 ppm
CorelDRAW: 1.2 gppm
Lotus 1-2-3 for Windows: 3.0 gppm



CG Times
Courier
Line Printer
Univers



DEC Laser 1152

\$949

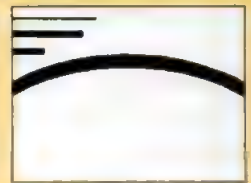
4-ppm laser printer (Canon LX engine) with 300-dpi output, Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 3.5 ppm
PCL Graphics Speed: 0.3 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 2.5 ppm
CorelDRAW: 0.4 gppm
Lotus 1-2-3 for Windows: 0.5 gppm

PS Text Speed: 3.9 ppm
PS Graphics Speed: 0.2 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 2.8 ppm
CorelDRAW: 0.3 gppm
Lotus 1-2-3 for Windows: 1.3 gppm



Courier
Helvetica
Σμβολ (symbol)
Times



Epson ActionLaser 1000

\$799

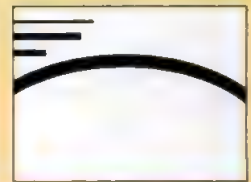
6-ppm laser printer (Minolta SP-6CL engine) with 300-dpi output, HP PCL 4; Adobe PostScript Interpreter, \$449

PCL Text Speed: 5.7 ppm
PCL Graphics Speed: 1.6 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 5.1 ppm
CorelDRAW: 1.3 gppm
Lotus 1-2-3 for Windows: 3.0 gppm

PS Text Speed: 2.9 ppm
PS Graphics Speed: 0.4 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 2.2 ppm
CorelDRAW: 0.5 gppm
Lotus 1-2-3 for Windows: 1.5 gppm



Courier
Line Printer



Epson ActionLaser 1500

\$989

6-ppm laser printer (Minolta SP-6CL engine) with 300-dpi output, HP PCL 5; Adobe PostScript Interpreter, \$449

PCL Text Speed: 5.8 ppm
PCL Graphics Speed: 1.4 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 5.2 ppm
CorelDRAW: 1.1 gppm
Lotus 1-2-3 for Windows: 2.7 gppm



Courier
Line Printer
Epson Roman T
Epson Sans serif



HP LaserJet 4L

\$849

4-ppm laser printer (Canon PX engine) with 300-dpi output, enhanced HP PCL 5

PCL Text Speed: 3.8 ppm
PCL Graphics Speed: 1.7 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 3.6 ppm
CorelDRAW: 0.4 gppm
Lotus 1-2-3 for Windows: 2.0 gppm



Albertus
Antique Ol
CG Times
Coronel
Courier
Letter Goth
Univers
Univers Condens
WingDings



Personal
Communications/3270

Make a list of everything an emulator should be. Then add a few more lines. With the new IBM Personal Communications/3270 V.3.1, you can have it all—and more. It's the most fully functional, most cost-effective emulator on the market. It even helps mask the complexity of your applications.

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PRINTERS

Mainstream Lasers



HP LaserJet 4M

\$2,399

8-ppm laser printer (Canon EX engine) with 600-dpi output, Adobe PostScript Level 2, enhanced HP PCL 5



Avant Garde Palatino
Bookman Symbol Σμμβ
Courier Times
Helvetica Zapf Chancery
Helvetica Narrow Zapf Dingbats
New Century



PCL Text Speed: 8.0 ppm
PCL Graphics Speed: 2.8 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 6.9 ppm
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 2.9 gppm
PS Text Speed: 7.8 ppm
PS Graphics Speed: 1.3 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 6.0 ppm
CorelDRAW: 1.3 gppm
Lotus 1-2-3 for Windows: 3.5 gppm

HP LaserJet 4ML

\$1,279

4-ppm laser printer (Canon PX engine) with 300-dpi output, Adobe PostScript Level 2, enhanced HP PCL 5



Avant Garde Palatino
Bookman Symbol Σμμβ
Courier Times
Helvetica Zapf Chancery
Helvetica Narrow Zapf Dingbats
New Century



PCL Text Speed: 3.8 ppm
PCL Graphics Speed: 1.7 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 3.6 ppm
CorelDRAW: 0.4 gppm
Lotus 1-2-3 for Windows: 2.0 gppm
PS Text Speed: 3.8 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 3.3 ppm
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 2.3 gppm

HP LaserJet 4MP

\$1,729

4-ppm laser printer (Canon PXII engine) with 600-dpi output, Adobe PostScript Level 2, enhanced HP PCL 5



Avant Garde Palatino
Bookman Symbol Σμμβ
Courier Times
Helvetica Zapf Chancery
Helvetica Narrow Zapf Dingbats
New Century



PCL Text Speed: 3.8 ppm
PCL Graphics Speed: 1.7 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 3.3 ppm
CorelDRAW: 0.4 gppm
Lotus 1-2-3 for Windows: 2.1 gppm
PS Text Speed: 3.8 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 3.3 ppm
CorelDRAW: 1.1 gppm
Lotus 1-2-3 for Windows: 2.2 gppm



HP LaserJet 4P

\$1,229

4-ppm laser printer (Canon PXII engine) with 600-dpi output, enhanced HP PCL 5; Adobe PostScript Level 2 interpreter, \$499



Albertus Courier
Antique Olive Letter Gothic
CG Times Univers
Carnegie WingDings



PCL Text Speed: 3.8 ppm
PCL Graphics Speed: 1.7 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 3.3 ppm
CorelDRAW: 0.6 gppm
Lotus 1-2-3 for Windows: 2.1 gppm

LaserMaster Unity 1200XL-O Plain-Paper Typesetter

\$8,995

8-ppm laser printer (Toshiba A-655 engine) with 1,200-dpi output, LaserMaster PostScript, HP PCL 4



Courier New Century
Helvetica Σμμβολ
ITC Avant G
ITC Bookman Times Roman
✱✱✱



PCL Text Speed: 4.5 ppm
PCL Graphics Speed: 2.2 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 4.0 ppm
CorelDRAW: 1.3 gppm
Lotus 1-2-3 for Windows: 2.2 gppm
PS Text Speed: 5.8 ppm
PS Graphics Speed: 1.3 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 2.4 ppm
CorelDRAW: 1.1 gppm
Lotus 1-2-3 for Windows: 2.3 gppm

PRINTERS

Mainstream Lasers

Lexmark IBM 4039 10R

\$1,599

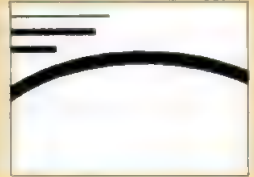
10-ppm laser printer (Lexmark 4039 engine) with 600-dpi output, Lexmark PostScript, HP PCL 5

PCL Text Speed: 8.7 ppm
PCL Graphics Speed: 1.1 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 7.6 ppm
CorelDRAW: 1.8 gppm
Lotus 1-2-3 for Windows: 4.2 gppm

PS Text Speed: 9.1 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 7.1 ppm
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 1.8 gppm



Courier Zapf Dingb
Helvetica Palatino
ITC Avant G Symbol
Bookman L Times Roman



Lexmark IBM 4039 10R Duplex

\$2,199

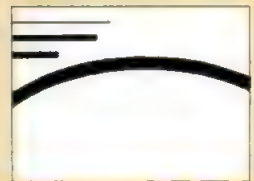
10-ppm laser printer (Lexmark 4039 engine) with 600-dpi output, Lexmark PostScript, HP PCL 5

PCL Text Speed: 7.1 ppm
PCL Graphics Speed: 2.4 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 6.0 ppm
CorelDRAW: 1.8 gppm
Lotus 1-2-3 for Windows: 4.3 gppm

PS Text Speed: 7.7 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 6.8 ppm
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 1.8 gppm



Courier Zapf Dingb
Helvetica Palatino
ITC Avant G Symbol
Bookman L Times Roman



NEC Silentwriter SuperScript 610

\$700 (estimated street price)

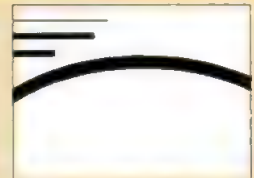
6-ppm laser printer (NEC LCR50 engine) with 300-dpi output, HP PCL 4; NEC's SuperScript PostScript interpreter, \$99

PCL Text Speed: N/A
PCL Graphics Speed: N/A
PCL WINDOWS APPLICATIONS:
Word for Windows: 4.1 ppm
CorelDRAW: 1.1 gppm
Lotus 1-2-3 for Windows: 1.9 gppm

PS Text Speed: N/A
PS Graphics Speed: N/A
PS WINDOWS APPLICATIONS:
Word for Windows: 4.1 ppm
CorelDRAW: 1.1 gppm
Lotus 1-2-3 for Windows: 2.8 gppm



Arial
Baxter
Calcutt
Campfire
Courier
Dixon
Eureka
Hancock
La Costa
Marin



N/A—Not applicable. This Windows GDI (Graphics Device Interface) printer could not complete our DOS-based tests.

NewGen ImagerPlus 12

\$7,495

8-ppm laser printer (Toshiba TN-7270 engine) with 1,200-dpi output, NewGen PostScript, HP PCL 4

PCL Text Speed: 2.9 ppm
PCL Graphics Speed: 0.4 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: N/A
CorelDRAW: N/A
Lotus 1-2-3 for Windows: N/A

PS Text Speed: 4.2 ppm
PS Graphics Speed: 0.4 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 3.3 ppm
CorelDRAW: 0.9 gppm
Lotus 1-2-3 for Windows: 1.5 gppm



Courier +*■*OO▼
Helvetica New Centur
ITC Avant G Palatino Rom
ITC Bookm: Times Roman



N/A—Not applicable. The printer was not fully compatible with this test.

NewGen Turbo PS/660 B

\$4,995

8-ppm laser printer (Canon BX engine) with 600-dpi output, NewGen PostScript, HP PCL 4

PCL Text Speed: 4.7 ppm
PCL Graphics Speed: 1.1 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: N/A
CorelDRAW: N/A
Lotus 1-2-3 for Windows: N/A

PS Text Speed: 6.8 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 3.7 ppm
CorelDRAW: 1.1 gppm
Lotus 1-2-3 for Windows: 1.5 gppm



Courier New Centur
Helvetica Symbol
ITC Avant G Palatino Rom
ITC Bookm: Times Roman
+*■*OO▼



N/A—Not applicable. The printer was not fully compatible with this test.

It all started
when you asked them
to share an HP LaserJet



printer.



HP's JetDirect card solves the problems of shared printing.

Shared printing has been a great way to make the most of your resources. Unfortunately, it also made printing a hassle. Until now.

With HP's JetPrint utility, printing status is delivered to each user's PC.

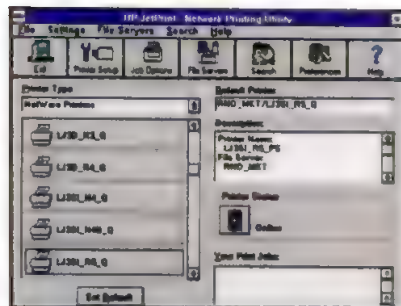
This powerful Windows™-based utility for Novell Network networks, included with HP's JetDirect card, provides users easy access to printer information. Users no longer have to jog over to the printer to check on job status. Just a simple click of the mouse and they can find out everything they need to know:



- Online/offline.
- Paper out/paper jam.
- Toner low.
- Printer cover open.
- Print job queues and priorities. And more.

No more hassles for them. No more complaints for you.

And no more network performance degradation or PC parallel-port bottlenecks. Print data zips along. Even graphics move along at breakneck speed. Network printer performance is maximized. It just doesn't get any better. Or faster.



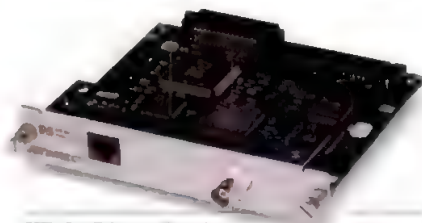
HP's JetDirect card makes your printer easy to manage.

How easy? Installation takes just minutes. And implementation is a breeze.

HP's JetAdmin utility provides remote management capabilities for Novell networks. Now printers can be placed anywhere on your network. Users can even automatically download Windows drivers for most popular PC applications. Which all makes the HP JetDirect card the preferred solution. With users. And with people like you.

Next time you buy an HP LaserJet printer, get an HP JetDirect card. Call 1-800-533-1333, Ext. 7569.

After all, why suffer with problems, when HP offers the perfect solution?



HP JetDirect Card

HP Printer Compatibility:

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PaintJet XL300, DeskJet 1200C • DesignJet,
DesignJet 600, 650C

JetDirect EX Interface -
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peripherals with a parallel port

Network Topologies:

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Windows for Workgroups • Windows NT •
IBM LAN Server • HP-UX, SunOS, Solaris, SCO
UNIX™ • Apple EtherTalk • Apple LocalTalk

Supports industry-standard SNMP-based network management software.

*Multiple network operating systems are supported simultaneously with the HP JetDirect card when installed into an HP LaserJet 4Si or 4Si MX printer

†Only NOS supported by JetDirect EX interface.

‡Not supported with Token Ring topology



**HEWLETT
PACKARD**

PRINTERS

Mainstream Lasers

NewGen Turbo PS/660p

\$1,995

4-ppm laser printer (Canon LPB-LX engine) with 600-dpi output, NewGen PostScript, HP PCL 4

PCL Text Speed: 3.4 ppm
PCL Graphics Speed: 1.0 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: N/A
CorelDRAW: N/A
Lotus 1-2-3 for Windows: N/A

PS Text Speed: 3.9 ppm
PS Graphics Speed: 0.8 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 2.4 ppm
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 1.6 gppm

N/A —Not applicable. The printer was not fully compatible with this test.



Courier New Centur
Helvetica Συμβολ
ITC Avant G Palatino Ron
ITC Bookma Times Roman
+*■*00▼



Okidata OL400e

\$699

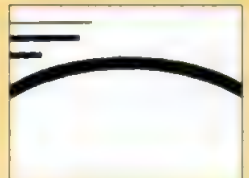
4-ppm laser printer (Oki Electric engine) with 300-dpi output, HP PCL 4.5

PCL Text Speed: 4.2 ppm
PCL Graphics Speed: 1.8 gppm

PS Text Speed: 3.9 ppm
PS Graphics Speed: 0.8 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 3.9 ppm
CorelDRAW: 1.1 gppm
Lotus 1-2-3 for Windows: 2.4 gppm



Courier
Dutch
Swiss Bold



Okidata OL850

\$1,999

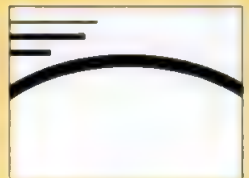
8-ppm laser printer (Oki Electric engine) with 300-dpi output, Adobe PostScript, HP PCL 4

PCL Text Speed: 8.1 ppm
PCL Graphics Speed: 2.2 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 5.6 ppm
CorelDRAW: 1.4 gppm
Lotus 1-2-3 for Windows: 2.4 gppm

PS Text Speed: 7.6 ppm
PS Graphics Speed: 0.5 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 4.8 ppm
CorelDRAW: 0.6 gppm
Lotus 1-2-3 for Windows: 2.0 gppm



Courier New Centur
Helvetica Συμβολ
ITC Avant G Palatino Ron
ITC Bookma Times Roman
+*■*00▼



Panasonic KX-P4440

\$1,449

10-ppm laser printer (Matsushita 4440 engine) with 300-dpi output, HP PCL 5

PCL Text Speed: 9.1 ppm
PCL Graphics Speed: 1.2 gppm

PS Text Speed: 7.6 ppm
PS Graphics Speed: 0.9 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 7.6 ppm
CorelDRAW: 0.9 gppm
Lotus 1-2-3 for Windows: 1.6 gppm



CG Times
Century
Courier
Univers



Panasonic SideWriter KX-P5400

\$999

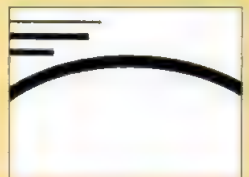
4-ppm laser printer (Matsushita 5400 engine) with 300-dpi output, Adobe PostScript Level 2, HP PCL 4

PCL Text Speed: 4.1 ppm
PCL Graphics Speed: 0.7 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 3.7 ppm
CorelDRAW: 0.8 gppm
Lotus 1-2-3 for Windows: 1.2 gppm

PS Text Speed: 4.0 ppm
PS Graphics Speed: 0.3 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 3.3 ppm
CorelDRAW: 0.3 gppm
Lotus 1-2-3 for Windows: 1.7 gppm



Helvetica
Helvetica Narrow
Συμβολ (Symbol)
Times



PRINTERS
Mainstream Lasers

QMS 420 Print System

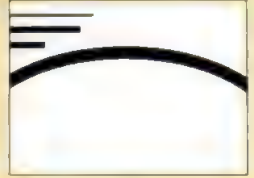
\$1,995

4-ppm laser printer (Canon LBP-LX engine) with 600-dpi output, QMS PostScript Level 2, HP PCL 4

PCL Text Speed: 3.8 ppm	PS Text Speed: 3.8 ppm
PCL Graphics Speed: 1.1 gppm	PS Graphics Speed: 0.4 gppm
PCL WINDOWS APPLICATIONS:	PS WINDOWS APPLICATIONS:
Word for Windows: 3.5 ppm	Word for Windows: 2.9 ppm
CorelDRAW: 0.7 gppm	CorelDRAW: 0.4 gppm
Lotus 1-2-3 for Windows: 1.3 gppm	Lotus 1-2-3 for Windows: 1.7 gppm



Courier ITC Zapf Dir
Helvetica Symbol
ITC Avant G Times Roman
ITC Bookm



QMS 860 Print System

\$4,595

8-ppm laser printer (Canon BX engine) with 600-dpi output, QMS PostScript Level 2, HP PCL 4

PCL Text Speed: 7.2 ppm	PS Text Speed: 7.2 ppm
PCL Graphics Speed: 1.2 gppm	PS Graphics Speed: 0.8 gppm
PCL WINDOWS APPLICATIONS:	PS WINDOWS APPLICATIONS:
Word for Windows: 6.3 ppm	Word for Windows: 5.6 ppm
CorelDRAW: 0.9 gppm	CorelDRAW: 0.7 gppm
Lotus 1-2-3 for Windows: 2.5 gppm	Lotus 1-2-3 for Windows: 3.2 gppm



Courier ITC Zapf Dir
Helvetica Symbol
ITC Avant G Times Roman
ITC Bookma



Samsung Finalé Hi-Res

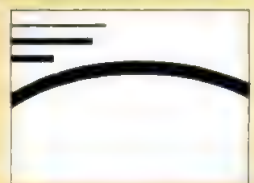
\$2,086

8-ppm laser printer (Samsung F-8000 engine) with 1,200-dpi effective output, Samsung PostScript, HP PCL 5

PCL Text Speed: 7.5 ppm	PS Text Speed: 7.2 ppm
PCL Graphics Speed: 2.4 gppm	PS Graphics Speed: 0.4 gppm
PCL WINDOWS APPLICATIONS:	PS WINDOWS APPLICATIONS:
Word for Windows: 6.8 ppm	Word for Windows: 3.9 ppm
CorelDRAW: 1.0 gppm	CorelDRAW: 1.4 gppm
Lotus 1-2-3 for Windows: 3.2 gppm	Lotus 1-2-3 for Windows: 2.2 gppm



BookAntiqua
BookmanOldStyle
CenturyGothic
CenturySchoolbook
MonotypeCorsiva
TimesNewRoman



Sharp JX-9400

\$599

6-ppm laser printer (Sharp JX-9400 engine) with 300-dpi output, HP PCL 4

PCL Text Speed: 6.6 ppm	PCL WINDOWS APPLICATIONS:
PCL Graphics Speed: 0.9 gppm	Word for Windows: 5.3 ppm
	CorelDRAW: 0.9 gppm
	Lotus 1-2-3 for Windows: 0.9 gppm



Courier
Line Printer



Star Micronics LS-5EX

\$989

5-ppm laser printer (Fuji Xerox engine) with 600- by 300-dpi output; HP PCL 5; Microsoft TrueImage PostScript emulator, \$225

PCL Text Speed: 4.1 ppm	PCL WINDOWS APPLICATIONS:
PCL Graphics Speed: 1.7 gppm	Word for Windows: 4.1 ppm
	CorelDRAW: 0.9 gppm
	Lotus 1-2-3 for Windows: 2.3 gppm



CG Times
Courier
Line Draw
Universal



PRINTERS

Mainstream Lasers

Tandy LP400

\$799

4-ppm laser printer (TEC LB1321-LC engine) with 300-dpi output, HP PCL 4



Courier

PCL Text Speed: 3.9 ppm
PCL Graphics Speed: 1.3 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 2 ppm
CorelDRAW: 1.1 gppm
Lotus 1-2-3 for Windows: 1.7 gppm

Tandy LP410

\$1,099

4-ppm laser printer (TEC LB1321-LC engine) with 300-dpi output, HP PCL 5; PageStyler PostScript emulator, \$399.99



CG Times
Courier
Universal

PCL Text Speed: 3.8 ppm
PCL Graphics Speed: 1.6 gppm

PCL WINDOWS APPLICATIONS:
Word for Windows: 3.6 ppm
CorelDRAW: 0.9 gppm
Lotus 1-2-3 for Windows: 0.5 gppm

Tandy LP800

\$1,499

8-ppm laser printer (TEC LB1323 engine) with 300-dpi output, HP PCL 5; PageStyler PostScript emulator, \$399.99



CG Times
Courier
Universal

PCL Text Speed: 7.8 ppm
PCL Graphics Speed: 2.4 gppm

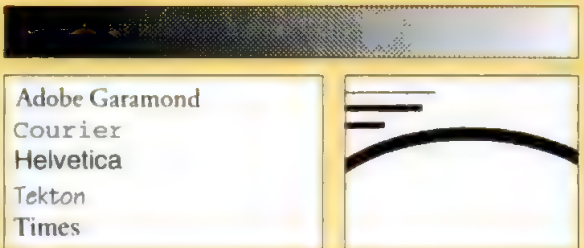
PCL WINDOWS APPLICATIONS:
Word for Windows: 6.4 ppm
CorelDRAW: 1.2 gppm
Lotus 1-2-3 for Windows: 2.4 gppm



TI microLaser Pro 600

\$1,599

8-ppm laser printer (Sharp JX-9660 engine) with 600-dpi output, Adobe PostScript Level 2, HP PCL 5



Adobe Garamond
Courier
Helvetica
Tekton
Times

PCL Text Speed: 4.5 ppm
PCL Graphics Speed: 3.2 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 2.9 ppm
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 2.7 gppm

PS Text Speed: 8.4 ppm
PS Graphics Speed: 1.3 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 6.3 ppm
CorelDRAW: 1.3 gppm
Lotus 1-2-3 for Windows: 3.5 gppm



TI microWriter

\$799

5-ppm laser printer (Samsung engine) with 300-dpi output, Adobe PostScript, HP PCL 4



Courier
Adobe Garamond
Helvetica
Συμβολ
Tekon
Times

PCL Text Speed: 4.5 ppm
PCL Graphics Speed: 1.2 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 4.1 ppm
CorelDRAW: 0.9 gppm
Lotus 1-2-3 for Windows: 1.4 gppm

PS Text Speed: 4.4 ppm
PS Graphics Speed: 0.5 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 3.3 ppm
CorelDRAW: 0.5 gppm
Lotus 1-2-3 for Windows: 1.7 gppm

WE'RE REDEFINING
WHAT YOU
SHOULD EXPECT
FROM
OFFICE PRINTERS.

Speed ('spēd) *n.* 1. A feature rarely found in low-cost inkjet printers. *example:* In letter quality mode, the **TI microMarc™** printer gives you laser quality printing at twice the *speed* of the HP DeskJet™ printer.



**THE
UNDER \$300
PRINTER,
REDEFINED.**

If you're looking for a printer with a street price under \$300*, you no longer have to settle for poor print quality or painfully slow print speed.

Now, for about the same price as a dot matrix printer, the TI microMarc, with its advanced inkjet technology, will give you the same 300 dpi print quality as most laser printers.

And unlike our biggest competitor, the HP DeskJet, instead of 50 nozzles applying ink to the page, we give you 128 nozzles. Which means that, in letter quality mode, we print text twice as fast. We also give you more memory than they do, for improved graphics. And the benefits don't stop there.

The TI microMarc is also easy to use, thanks to its new high-capacity, easy to replace ink cartridge.

The TI microMarc. It's so quiet, so reliable, so inexpensive to run and easy to use, it can help you get more from your printer than you ever thought possible. At a price you probably never thought possible. For more information or a dealer near you, call **1-800-527-3500**.

	TI microMarc	HP DeskJet 500
Speed (in letter quality mode)	300cps	120cps
# Of Nozzles	128	50
Print Quality	300 dpi	300 dpi
Memory	24K	16K
Pages/Cartridge	1400	1000
Weight	12.1 lbs.	14.3 lbs

Flexibility (flek·sə·bil·ə·tē) *n.* 1. A feature previously not found in this category. *example:* For under \$800, **TI microWriter™** printers give you the *flexibility* to start with **Adobe® PostScript®** or add it later; the comparable HP 4L does not.



**THE
UNDER \$800
PRINTER,
REDEFINED.**

If you're looking for a printer with a street price well under \$800, you'll have a hard time finding one with as many features as a TI microWriter.

Let's compare it to our leading competitor, HP, starting with basic models. First, take flexibility. Ours lets you add PostScript now or later. With the HP 4L you can't add it at all. Take paper handling. Ours comes with a 250-sheet tray standard, theirs with just a 100-sheet. Speed? We give you 5 ppm, they give you 4. Yet in spite of all this, we still list for hundreds of dollars less.

Now, let's compare high end models. As you'll see from the

chart, the features here are basically comparable – till you get to price. And once again, the TI microWriter is clearly the better value. For more information or a dealer near you, call 1-800-527-3500.

	TI microWriter Basic	HP 4L	TI microWriter PS23	HP 4ML
Print Speed	5 ppm	4 ppm	5 ppm	4 ppm
PostScript	Upgradeable	No	Standard	Standard
Paper Trays	(std.) 250 sheet	100 sheet	250 sheet	100 sheet
	(opt.) 250 sheet	Not Avail.	250 sheet	Not Avail.
List Price	\$599	\$849	\$799	\$1279

EXTENDING YOUR REACH
WITH INNOVATION™

 **TEXAS
INSTRUMENTS**



Adobe PostScript



Compatibility (kəmˌpat·əˈbil·ət·ē) *n.* 1, A feature typically lacking in this category. *example:* The new **600 dpi TI microLaser™ Pro 600** printer gives you DOS, Windows, Mac, PCL5 and PostScript® compatibility standard; HP charges hundreds more.



Adobe PostScript

Specifications in chart are based on information, as of 9/93. *Estimated dealer price including manufacturer's rebate is under \$1400. Dealer prices may vary. †At 4% coverage. ‡Rebate applies to PS23 model. microLaser and "Extending Your Reach With Innovation" are trademarks of Texas Instruments. Adobe, PostScript and the PostScript logo are registered trademarks of Adobe Systems, Inc. LaserJet is a registered trademark of Hewlett-Packard, Inc. Mac is a registered trademark of Apple Computer, Inc. © 1993 TI

**THE
UNDER \$1400
PRINTER,
REDEFINED.**

If you're looking for a true 600 dpi printer with a street price under \$1400, you'll have a tough time beating the new TI microLaser Pro 600.

You see, when we set out to design the ideal office printer, we began by asking thousands of users what they wanted most. And then, instead of making those "key care-about's" optional, as others do, we made them standard.

Take print quality. We began with true 600 dpi resolution. And then enhanced it with 6MB of memory for improved graphics. Compatibility? We're DOS, Windows and Mac compatible right out of the box. With all the right languages and interfaces. And with the intelligence to switch these automatically, depending on the environment. Low maintenance? Our new toner cartridge typically gives you 15,000 pages between changes.

Paper handling? Two 250-sheet trays come standard. And finally, value. As the chart below shows, not only do we give you a lot more than our leading competitor, we also charge you a lot less.

So if you're considering a new printer, we invite you to try the new TI microLaser Pro 600. For more information or a dealer near you, call **1-800-527-3500**.

*Ask
About Our \$60
Introductory
Rebate.**

	TI microLaser Pro 600	HP LaserJet® 4	HP LaserJet 4M
True 600 dpi	Yes	Yes	Yes
Speed/Processor	8 ppm/RISC	8 ppm/RISC	8 ppm/RISC
Memory	6MB	2MB	6MB
Emulations	PCL5/ Adobe® PostScript 2	PCL5E	PCL5E/ Adobe PostScript 2
Compatibility	DOS/Mac	DOS	DOS/Mac
Toner Cart. Life	15K pages ¹	6K pages	6K pages
Paper Trays	250 sheet/ 250 sheet	250 sheet/ 100 sheet	250 sheet/ 100 sheet
Auto Language Switching	Yes	No	Yes
Auto Interface Switching	Yes	Yes	Yes
List Price	\$1599*	\$1759	\$2399

**EXTENDING YOUR REACH
WITH INNOVATION™**

 **TEXAS
INSTRUMENTS**

PRINTERS
Mainstream Lasers

Xante Accel-a-Writer 4000

\$1,795

4-ppm laser printer (Canon LBP-LX engine) with 600-dpi output, PhoenixPage PostScript, HP PCL 4

PCL Text Speed: 3.9 gppm	PS Text Speed: 3.6 ppm
PCL Graphics Speed: 1.8 gppm	PS Graphics Speed: 0.8 gppm
PCL WINDOWS APPLICATIONS:	PS WINDOWS APPLICATIONS:
Word for Windows: 3.8 ppm	Word for Windows: 2.7 ppm
CorelDRAW: 1.0 gppm	CorelDRAW: 0.8 gppm
Lotus 1-2-3 for Windows: 1.9 gppm	Lotus 1-2-3 for Windows: 2.2 gppm



Avant Gard	Palatino
Bookman	Συμβολ (Sy)
Courier	Times
Helvetica	Zapf Chancery
Helvetica Narrow	(Zapf Dingb)
New Century	*****



Xante Accel-a-Writer 8100

\$3,995

8-ppm laser printer (Canon LBP-BX engine) with 1,200-dpi output, PhoenixPage PostScript, HP PCL 4

PCL Text Speed: 4.1 ppm	PS Text Speed: 7.3 ppm
PCL Graphics Speed: 2.2 gppm	PS Graphics Speed: 1.0 gppm
PCL WINDOWS APPLICATIONS:	PS WINDOWS APPLICATIONS:
Word for Windows: 4.0 ppm	Word for Windows: 5.7 ppm
CorelDRAW: 1.3 gppm	CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 1.3 gppm	Lotus 1-2-3 for Windows: 3.5 gppm



Avant Gard	Palatino
Bookman	Συμβολ (Sy)
Courier	Times
Helvetica	Zapf Chancery
Helvetica Narrow	(Zapf Dingb)
New Century	*****



Hewlett-Packard Co.

HP LaserJet 4L

HP LaserJet 4M

HP LaserJet 4ML

HP LaserJet 4MP

HP LaserJet 4P

BY EDWARD MENDELSON

True to Hewlett-Packard tradition, the company's two new pairs of 4-page-per-minute laser printers offer superior design and features at affordable prices. The 300-dot-per-inch HP LaserJet 4L, with its \$849 list price and \$649 typical street price, has established the lead for other low-cost contenders to follow. The HP LaserJet 4P, which lists for \$1,229 and sells on the street for around \$945, is one of the least expensive 600-dpi printers you'll find. Similar models of these printers are available with a true Adobe PostScript Level 2 interpreter; with that feature, they're called the HP LaserJet 4ML (\$1,279 list, \$979 street) and HP LaserJet 4MP (\$1,729 list, \$1,329 street). Again this year we tested the HP LaserJet 4M, now \$2,399 (\$1,849 street price), which won an Editors' Choice award last year for providing 8-ppm per-

formance and 600-dpi quality on top of true Adobe PostScript Level 2 support.

The four new HP printers garnered the best results by far on our Power Consumption test. And power isn't all these printers conserve: Their optional draft mode prints passable output using half the normal amount of toner.

The new models also incorporate some of the features of Microsoft's Windows Printing System (a plug-in cartridge for the HP LaserJet II and 3 series). These include, most notably, improved two-way communication that results in enhanced status reports. And all provide HP's Memory Enhancement technology, a compression technique that the company says effectively doubles memory. HP's Resolution Enhancement Technol-

ogy is supported as well, so output is free of significant jaggies. Output from the 600-dpi models is especially impressive.

The LaserJet 4L and LaserJet 4ML are 300-dpi personal printers based on the Canon PX engine. Both have a single bin that holds 100 sheets of paper; neither unit accepts font cartridges.

The LaserJet 4L comes with 1MB of RAM (expandable to 2MB) and 26 Intellifonts. Text speed was typical for 4-ppm printers, and PCL graphics performance was strong. The LaserJet 4ML is a similar model that comes with Adobe PostScript Level 2 support and 4MB of RAM. It also includes 35 Intellifonts, 10 TrueType fonts, and 35 Type 1 fonts.

The LaserJet 4P and LaserJet 4MP are based on a 600-dpi Canon PXII engine.



HP LaserJet 4P, HP LaserJet 4L, HP LaserJet 4M

Satisfaction (,sat·əs·'fak·shən) *n.* 1, A feature previously left to chance in the purchase of a printer. *example:* When you buy a new TI printer*, your **satisfaction** is **guaranteed** or call TI within 30 days and we'll take it back.



TEXAS INSTRUMENTS



THE
WAY YOU BUY A
PRINTER,
REDEFINED.

In the past year, we've introduced a whole new line of office printers. And as you've seen in the previous pages, they're some of the most advanced models on the market today. But now, we're also going to change the way you buy a printer.

When you buy one of these new TI printers, if you need any help at all, simply call us toll-free at 1-800-TI-TEXAS, and we'll work with you. Then, within 30 days from date of purchase, if you're still not completely happy, call TI and we'll take it back. It's as easy as that. That's how confident we are in each

and every printer we make. And even after the 30 days, you can continue to call the 800 number for any help you may need.

For more information about the TI microMarc™, the TI microWriter™ or the new TI microLaser™ Pro 600 printers, and for the name of a dealer near you, call 1-800-527-3500. And see for yourself how TI is redefining what you should expect from an office printer.

EXTENDING YOUR REACH
WITH INNOVATION™

 **TEXAS
INSTRUMENTS**

* Offer applies to all new TI microMarc, microWriter and microLaser Pro 600 printers, if returned in good condition. microMarc, microWriter, microLaser and "Extending Your Reach With Innovation" are trademarks of Texas Instruments. © 1993 TI

CIRCLE 353 ON READER SERVICE CARD

PRINTERS

Mainstream Lasers

Both hold 250 sheets and provide a straight-through paper path for thick paper and envelopes. Text and graphics printing speed results for both were good. Unlike many other 600-dpi printers here, the LaserJet 4P and LaserJet 4MP print at their full resolution even under PCL.

The LaserJet 4P comes with 2MB of RAM (expandable to 26MB) and includes 35 Intellifonts and 10 TrueType fonts. It also accepts PCL font cartridges. You can add PostScript Level 2 support with a \$499 SIMM or \$299 cartridge. The LaserJet 4MP includes an Adobe PostScript Level 2 interpreter and 6MB of RAM (expandable to 22MB).

Last year, the LaserJet 4M set the standard for high-quality output, solid performance, and effortless operation. Its features haven't changed; they include 6MB of RAM (expandable to 32MB), 2 paper trays, 35 Intellifonts, 10 TrueType fonts, and 35 Type 1 fonts. A LocalTalk port is standard, so it should be easy to connect the LaserJet 4M to Macintosh networks (thus the M suffix).

The LaserJet 4M has an 8-ppm, 600-

dpi Canon EX engine and a 20-MHz Intel 80960KA RISC processor. The printer turned in very high scores on our text and graphics tests. It comes with 35 Intellifonts, 10 TrueType fonts, and 35 Type 1 fonts, as well as 6MB of RAM (expandable to 32MB).

The HP LaserJet 4 line offers some of the most impressive technology you'll find—at standard-setting prices.

Hewlett-Packard Co., P.O. Box 58059, MS511L-SJ, Santa Clara, CA 95051-8059; 800-752-0900; fax, 800-333-1917.

EDITORS' CHOICE ► HP LaserJet 4L List price: \$849; 1MB RAM upgrade, \$99; Ethernet interface, \$499; Token-Ring interface, \$699; toner/developer/drum unit, \$85. Emulations: HP PCL 5, HPGL.

EDITORS' CHOICE ► HP LaserJet 4M List price: \$2,399; 1MB RAM upgrade, \$109; 4MB RAM upgrade, \$279; 8MB RAM upgrade, \$539; emulation card (IBM Proprinter or Epson FX), \$199; 500-sheet multipurpose cassette, \$349; Ethernet interface (10BaseT or 10BaseT and BNC), \$499; Token-Ring interface, \$699; toner/developer/drum unit, \$150.

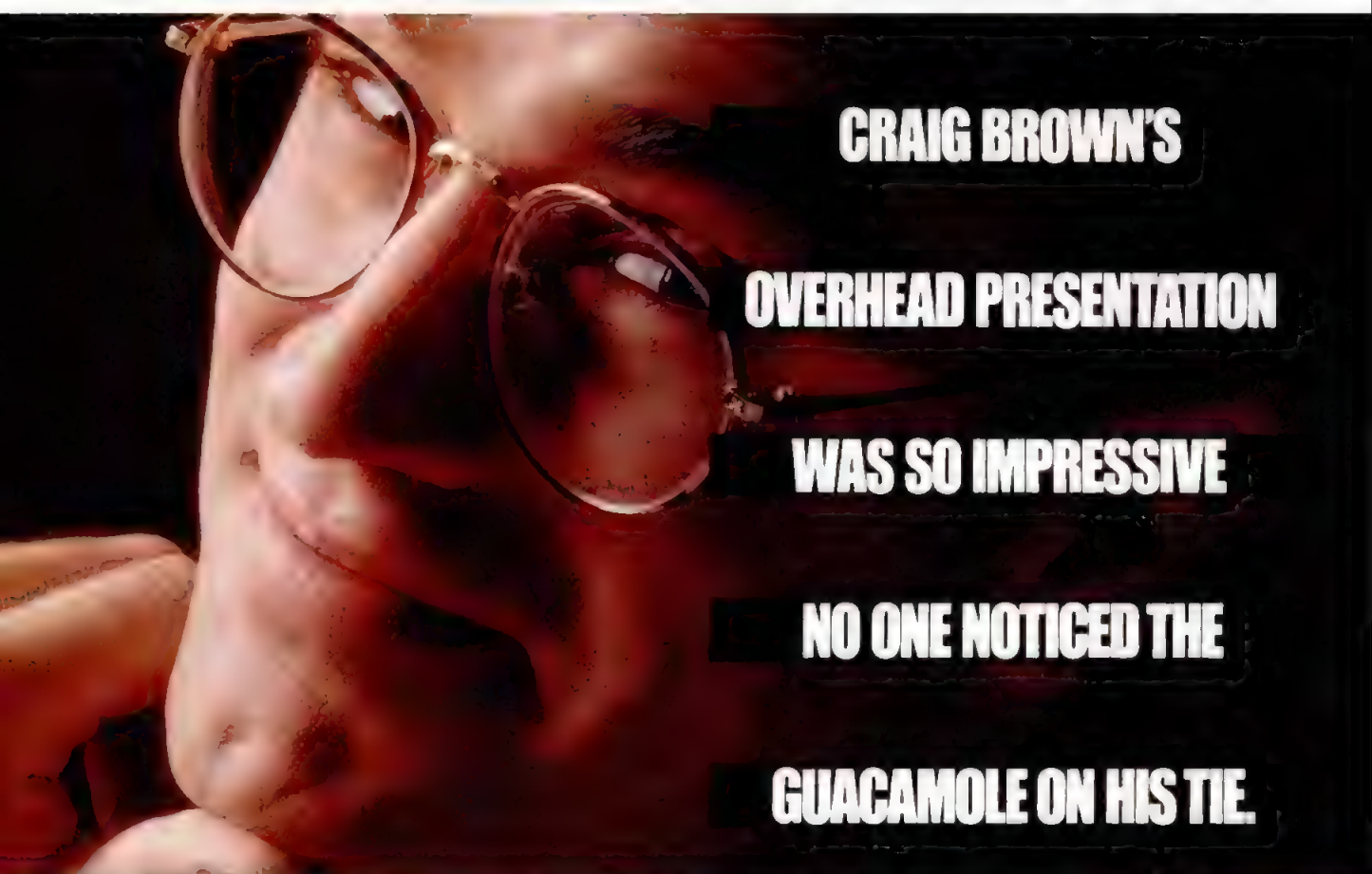
Emulations: Adobe PostScript Level 2, HP PCL 5, HPGL.

HP LaserJet 4ML List price: \$1,279; Token-Ring interface, \$699; toner/developer/drum unit, \$85. Emulations: Adobe PostScript Level 2, HPGL, HP PCL 5.

HP LaserJet 4MP List price: \$1,729; 1MB RAM upgrade, \$109; 2MB RAM upgrade, \$189; 4MB RAM upgrade, \$279; 8MB RAM upgrade, \$539; emulation card (Epson FX or IBM Proprinter), \$199; Ethernet interface, \$499; Token-Ring interface, \$699; toner/developer/drum unit, \$85. Emulations: Adobe PostScript Level 2, HP PCL 5, HPGL.

EDITORS' CHOICE ► HP LaserJet 4P List price: \$1,229; 1MB RAM upgrade, \$109; 2MB RAM upgrade, \$189; 4MB RAM upgrade, \$279; 8MB RAM upgrade, \$539; emulation card (Epson FX or IBM Proprinter), \$199; Adobe PostScript Level 2 emulation card, \$299; Adobe PostScript Level 2 SIMM, \$499; Ethernet interface, \$499; Token-Ring interface, \$699; toner/developer/drum unit, \$85. Emulations: HP PCL 5, HPGL.

Circle 475 on reader service card



CRAIG BROWN'S

OVERHEAD PRESENTATION

WAS SO IMPRESSIVE

NO ONE NOTICED THE

GUACAMOLE ON HIS TIE.

Mainstream Lasers

LaserMaster Corp.

LaserMaster Unity 1200XL-O Plain-Paper Typesetter

BY JOSEPH DESPOSITO

The LaserMaster Unity 1200XL-O Plain-Paper Typesetter (\$8,995) offers exceptional-quality 1,200- by 1,200-dot-per-inch resolution. It includes 235 Type 1 typefaces, and you can print on sheets of up to 12 by 19.5 inches or tabloid-size pages (11 by 17 inches) with full bleeds and registration and crop marks. Since the company sells direct to dealers and end users, you're unlikely to see the unit discounted anywhere.

The unit's 600-dpi Toshiba A-655 engine uses a separate drum and two-stage toner process. The engine doesn't deliver 1,200 dpi directly but relies on LaserMaster's proprietary TurboRes resolution-enhancement and TurboGray halftone-enhancement technologies to generate an effective 1,200- by 1,200-dpi resolution

in text and graphics. TurboGray improves halftone images by providing increased gray levels at high screen frequencies. Text printed at 1,200 dpi was crisp and dark during testing, and halftones were of near-photographic quality.

The Unity 1200XL-O is powered by a 33-MHz, 32-bit proprietary RISC processor. Page description languages are LaserMaster Enhanced TrueImage (which is PostScript compatible) and HP PCL 4. The unit automatically senses emulations and does automatic port switching among built-in LocalTalk, parallel, serial, and Ethernet ports. An 80MB hard disk and 32MB of RAM are standard.

Paper up to 11 by 17 inches fits into a cassette under the printer. Different sizes require you to place different plastic "keys" into the cassette. A rear-mounted multipurpose feeder lets you print tabloid-size full bleeds on oversize paper.

The 8-page-per-minute printer mustered less than 6 ppm on our Text Speed test in PostScript mode and fared even worse in PCL 4 mode. But its scores on our Graphics Speed test were good.



Those seeking alternatives to more costly traditional typesetters should consider this unit.

LaserMaster Corp., 6900 Shady Oak Rd., Eden Prairie, MN 55344; 800-950-6868, 612-944-9330; fax, 612-944-0522.

LaserMaster Unity 1200XL-O Plain-Paper Typesetter List price: \$8,995; 100 additional fonts, \$295; Novell Pocket Print Server card, \$695; second multipurpose paper cassette, \$549; toner, \$69; drum kit, \$699. Emulations: HP PCL 4, PostScript.

Circle 476 on reader service card



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and prints that rivet your
audience's attention.
Made easily and affordably.
Right at your desktop.**

The KODAK COLOREASE PS Printer. Continuous-tone transparencies and prints. Superb resolution. Plus UltraColor Software from Kodak that gives you great color the first time, and every time. True Adobe PostScript Level 2. Fully compatible with your MACINTOSH Computer or WINDOWS Software. With simultaneous printing and processing to maximize your productivity. No other printer can do so much, so fast.

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Call 1-800-344-0006 in U.S. or 1-800-465-6325 in Canada for a sample transparency and dealer information.

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CIRCLE 382 ON READER SERVICE CARD

KODAK

ColorEase
PS Printer



PRINTERS
Mainstream Lasers

► **S U M M A R Y O F F E A T U R E S**

Laser Printers

Products listed in alphabetical order

■ = YES □ = NO

	Apple LaserWriter Pro 600	Apple LaserWriter Pro 630	Apple LaserWriter Select 310	Brother Laser Printer HL-6	Brother Laser Printer HL-10h	Citizen ProLaser 6000
List price	\$2,099	\$2,529	\$1,079	\$895	\$1,549	\$849
Physical Characteristics						
Dimensions (HWD, in inches)	12.1 x 16.8 x 16.9	12.1 x 16.8 x 16.9	8 x 15 x 18.3	12.2 x 17.1 x 25	10.9 x 15.8 x 14.6	8.9 x 14.1 x 17.9
Weight (pounds)	39	39	26	30	37	22
Engine type	Laser	Laser	Laser	Laser	Laser	Laser
Engine model	Canon EX	Canon EX	Fuji Xerox	Brother HL-6	Brother HL-10h	Minolta
Maximum resolution in HP PCL (dpi)	300 x 300	300 x 300	N/A †	300 x 300	600 x 600	300 x 300
Maximum resolution in PostScript (dpi)	600 x 600	600 x 600	300 x 300	300 x 300	600 x 600	N/A †
RISC processor	N/A †	N/A †	16-MHz AMD Am29205	N/A †	N/A †	13-MHz AMD Am29200
Rated engine speed (pages per minute)	8	8	5	6	10	6
Single-cartridge toner/developer/drum	■	■	■	■	■	■
Toner capacity (images)	4,000	6,000	4,000	3,500	4,000	6,000
Standard, maximum RAM	8MB, 32MB	8MB, 32MB	1.5MB, 5.5MB	512K, 4.5MB	2MB, 32MB	1MB, 5MB
Accepts standard SIMMs	■	■	■	■	■	□
Interfaces						
Parallel/serial port	■ ■	■ ■	■ □	■ ■	■ ■	■ ■
LocalTalk port	■	■	■	□	Optional	□
SCSI port for hard disk	□	■	□	□	■	□
Ethernet	□	■	□	□	Optional	□
Token-Ring	□	□	□	□	Optional	□
Automatic interface switching	■	■	■	■	■	■
Simultaneously active ports	■	■	■	■	■	■
Paper Handling						
Capacity of each standard input cassette (sheets)	250, 100	250, 100	250	150	250	150
Capacity of each standard output tray (sheets)	250	250	250	50	250	100
Can print on B-size paper	□	□	□	□	□	□
Duplexing	□	□	□	□	□	□
Rated maximum paper weight (pounds)	28	28	28	28	36	24
Fonts and Features						
HP PCL support	PCL 4	PCL 4	None	PCL 4	PCL 5e	PCL 5
Accepts HP-compatible font cartridges	□	□	□	■	■	■
PostScript language support	Adobe PostScript Level 2	Adobe PostScript Level 2	Adobe PostScript	None	BR-Script	None
Number of Type 1 fonts provided	35	35	17	N/A ‡	35	N/A ‡
Automatic emulation switching	■	■	□	■	■	■
Resolution enhancement	■	■	□	□	■	■
Printer-specific Windows 3.1 driver available	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)	■ (via BBS)
Customer Support						
Toll-free technical support	■	■	■	■	■	□
Telephone support hours (eastern time)	9:00-9:00 M-F	9:00-9:00 M-F	9:00-9:00 M-F	9:15-7:00 M-F	9:15-7:00 M-F	11:00-7:00 M-Th, 11:00-6:00 F
BBS	□	□	□	■	■	■
Warranty	1 year	1 year	1 year	2 years	2 years	2 years

N/A †—Not applicable. The product does not have this feature N/A ‡—Not applicable. This unit is not a PostScript printer

PRINTERS
Mainstream Lasers

CONTINUES

PC MAGAZINE PC MAGAZINE PC MAGAZINE								
Claser 1152	Epson ActionLaser 1000	Epson ActionLaser 1500	HP LaserJet 4L	HP LaserJet 4M	HP LaserJet 4ML	HP LaserJet 4MP	HP LaserJet 4P	LaserMaster Unity 1200XL-0 Plain-Paper Typesetter
\$949	\$799	\$999	\$849	\$2,399	\$1,279	\$1,729	\$1,229	\$8,995
13.8 x 15.9	8.9 x 14.5 x 18	8.9 x 14.5 x 18	6.5 x 14.5 x 14	11.7 x 16.4 x 15.9	6.5 x 14.5 x 14	6.8 x 14.7 x 15.4	6.8 x 14.7 x 15.4	8.2 x 19.1 x 27.6
25	22	22	16	37	16	20	20	54
Laser	Laser	Laser	Laser	Laser	Laser	Laser	Laser	Laser
Canon LX	Minolta SP-6CL	Minolta SP-6CL	Canon PX	Canon EX	Canon PX	Canon PXII	Canon PXII	Toshiba A-655
300 x 300	300 x 300	300 x 300	300 x 300	600 x 600	300 x 300	600 x 600	600 x 600	600 x 600
300 x 300	300 x 300	300 x 300	N/A	600 x 600	300 x 300	600 x 600	600 x 600	1,200 x 1,200
N/A †	N/A †	N/A †	N/A †	20-MHz Intel 80960KA	20-MHz Intel 80960KA	20-MHz Intel 80960KA	16-MHz Intel 80960SA	33-MHz proprietary CPU
4	6	6	4	8	4	4	4	8
■	■	■	■	■	■	■	■	□
3,300	6,000	6,000	3,000	6,000	3,000	3,000	3,000	5,000
1MB, 2MB	512K, 6.5MB	1MB, 5MB	1MB, 2MB	6MB, 32MB	4MB, 4MB	6MB, 22MB	2MB, 26MB	32MB, 48MB
□	□	□	□	■	■	■	■	■
■ ■	■ Optional	■ ■	■ □	■ ■	■ □	■ ■	■ ■	■ ■
■	Optional	Optional	□	■	■	■	□	■
□	□	□	□	□	□	□	□	■
□	□	□	□	Optional	□	Optional	Optional	■
□	□	□	Optional	Optional	Optional	Optional	Optional	□
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	□
70	150	150	100	350, 100	100	250	250	250
50	100	100	50	250	50	100	100	150
□	□	□	□	□	□	□	□	□
□	□	□	□	□	□	□	□	□
25	42	42	36	28	36	36	36	32
PCL 4	PCL 4	PCL 5	PCL 5e	PCL 5e	PCL 5e	PCL 5e	PCL 5e	PCL 4
□	■	■	□	■	□	□	■	□
Adobe PostScript Level 2	Optional (Adobe PostScript)	Optional (Adobe PostScript)	None	Adobe PostScript Level 2	Adobe PostScript Level 2	Adobe PostScript Level 2	Optional (Adobe PostScript Level 2)	LaserMaster PostScript
17	N/A †	N/A †	N/A †	35	35	35	N/A †	235
□	■	■	□	■	■	■	■	■
■	□	■	■	■	■	■	■	■
■	□	□	■	■	■	■	■	■
in Windows)			(included)	(included)	(included)	(included)	(included)	(included)
■	■	■	□	□	□	□	□	□
A.M.-8:00 P.M. M-F	9:00-9:00 M-F	9:00-9:00 M-F	10:00-9:00 M-F	10:00-9:00 M-F	10:00-9:00 M-F	10:00-9:00 M-F	10:00-9:00 M-F	10:00-7:00 M-F
□	■	■	■	■	■	■	■	■
1 year	2 years	2 years	1 year	1 year	1 year	1 year	1 year	1 year

PRINTERS
Mainstream Lasers

► **S U M M A R Y O F F E A T U R E S**

Products listed in alphabetical order

■ = YES □ = NO

	Lexmark IBM 4039 10R	Lexmark IBM 4039 10R Duplex	NEC Silentwriter SuperScript 610	NewGen ImagerPlus 12	NewGen Turbo PS/660 B	NewGen Turbo PS/660p
List price	\$1,599	\$2,199	\$700 (estimated street price)	\$7,495	\$4,995	\$1,995
Physical Characteristics						
Dimensions (HWD, in inches)	11.8 x 14.9 x 21	11.8 x 14.9 x 21	4.7 x 14.6 x 14	8.5 x 19 x 28	11.8 x 18.3 x 21	7.5 x 13.5 x 16.3
Weight (pounds)	40	40	17	55	42	23
Engine type	Laser	Laser	Laser	Laser	Laser	Laser
Engine model	Lexmark 4039	Lexmark 4039	NEC LCR50	Toshiba TN-7270	Canon BX	Canon LPB-LX
Maximum resolution in HP PCL (dpi)	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300
Maximum resolution in PostScript (dpi)	600 x 600	600 x 600	N/A †	1,200 x 1,200	1,200 x 1,200 *	600 x 600
RISC processor	16-MHz AMD Am29200	16-MHz AMD Am29200	N/A †	25-MHz Weitek XL8220	25-MHz Weitek XL8220	25-MHz Weitek XL8220
Rated engine speed (pages per minute)	10	10	6	8	8	4
Single-cartridge toner/developer/drum	■	■	■	□	■	■
Toner capacity (images)	10,000	10,000	4,000	5,000	5,000	3,500
Standard, maximum RAM	2MB, 16MB	2MB, 16MB	256K, 256K	40MB, 96MB	12MB, 96MB	6MB, 32MB
Accepts standard SIMMs	■	■	□	□	□	□
Interfaces						
Parallel/serial port	■ ■	■ ■	■ □	■ ■	■ ■	■ ■
LocalTalk port	Optional	Optional	□	■	■	■
SCSI port for hard disk	□	□	□	■	■	Optional
Ethernet	Optional	Optional	□	Optional	Optional	Optional
Token-Ring	Optional	Optional	□	□	□	□
Automatic interface switching	■	■	□	■	■	■
Simultaneously active ports	■	■	□	■	■	■
Paper Handling						
Capacity of each standard input cassette (sheets)	200	200	50	250	250	70
Capacity of each standard output-tray (sheets)	250	250	50	150	250	150 (top), 70 (rear)
Can print on B-size paper	□	□	□	■	■	□
Duplexing	Optional	■	□	□	□	□
Rated maximum paper weight (pounds)	24	24	28	36	36	36
Fonts and Features						
HP PCL support	PCL 5	PCL 5	PCL 4	PCL 4	PCL 4	PCL 4
Accepts HP-compatible font cartridges	■	■	□	□	□	□
PostScript language support	Lexmark PostScript	Lexmark PostScript	Optional (NEC SuperScript)	NewGen PostScript	NewGen PostScript	NewGen PostScript
Number of Type 1 fonts provided	35	35	None	35	35	35
Automatic emulation switching	■	■	□	■	■	■
Resolution enhancement	■	■	■	■	■	■
Printer-specific Windows 3.1 driver available	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)
Customer Support						
Toll-free technical support	□	□	■	■	■	■
Telephone support hours (eastern time)	10:00–7:00 M–F	10:00–7:00 M–F	8:00–8:00 M–F	9:30–9:30 M–F	9:30–9:30 M–F	9:30–9:30 M–F
BBS	■	■	■	■	■	■
Warranty	1 year	1 year	2 years	1 year	1 year	1 year

N/A †—Not applicable: The product does not have this feature N/A ‡—Not applicable: This unit is not a PostScript printer

PRINTERS
Mainstream Lasers

CONTINUES



Okidata DL400e	Okidata DL850	Panasonic KX-P4440	Panasonic SideWriter KX-P5400	QMS 420 Print System	QMS 860 Print System	Samsung Finalé Hi-Res	Sharp JX-9400	Star Micronics LS-5EX
\$699	\$1,999	\$1,449	\$999	\$1,995	\$4,595	\$2,086	\$599	\$989
12.6 x 19.5	6 x 17.3 x 31	11.3 x 14.5 x 15.5	11.5 x 4.8 x 15	26.1 x 13.5 x 7.5	12 x 18.9 x 20.7	9.5 x 17 x 17	10.5 x 13 x 14	10.2 x 13.5 x 16
17	24	40	15	26	52	51	27	30
LED array	LED array	Laser	LED array	Laser	Laser	Laser	Laser	Laser
Ok Electric	Ok Electric	Matsushita 4440	Matsushita 5400	Canon LBP-LX	Canon BX	Samsung F-8000	Sharp JX-9400	Fuji Xerox
300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	600 x 300
N/A †	300 x 300	N/A †	300 x 300	600 x 600	600 x 600	1,200 x 1,200 (effective)	N/A †	600 x 300
16-MHz MIPS R3000	N/A †	16-MHz Intel 80960	N/A †	N/A †	25-MHz Intel 80960CA	16-MHz Intel 80960KA	N/A †	16-MHz Intel 80960SA
4	8	10	4	4	8	8	6	5
☐	☐	☐	☐	☒	☒	☐	☐	☒
2,000	2,500	3,000	2,000	3,500	6,000	3,500	5,000 (initial), 15,000 (replacement)	4,500
2K, 4.5MB	2MB, 4MB	1MB, 5MB	2MB, 4MB	6MB, 10MB	12MB, 32MB	6MB, 18MB	512K, 4.5MB	1MB, 7MB
☐	☐	☐	☐	☒	☒	☐	☐	☐
☒	☒	☒	☒ Optional	☒	☒	☒	☒ Optional	☒
☐	☒	☐	Optional	☒	☒	Optional	☐	☒
☐	☐	☐	☐	☐	☒	☐	☐	☐
☐	☐	☐	☐	☐	Optional	☐	☐	☐
☐	☐	☐	☐	☐	Optional	Optional	☐	☐
☒	☐	☐	☐	☒	☒	☒	☐	☒
☐	☐	☒	☐	☒	☒	☒	☐	☒
100	200	200	100	70	250, 100	250	250	250
100	200	100	50	50 (facedown), 20 (faceup)	250	250	250	150
☐	☐	☐	☐	☐	☒	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐	☐	☐
35	35	35	32	28	36	35	34	28
PCL 4.5	PCL 4	PCL 5	PCL 4	PCL 4	PCL 4	PCL 5	PCL 4	PCL 5
☐	☐	☐	☐	☒	☐	☒	☐	☒
None	Adobe PostScript	None	Adobe PostScript Level 2	QMS PostScript Level 2	QMS PostScript Level 2	Samsung PostScript	None	Optional (TrueImage)
N/A †	35	N/A †	17	35	35	35	N/A †	N/A †
☐	☒ (through software)	☐	☐	☒	☒	☒ (Windows only)	☐	☒
☐	☒	☒	☐	☐	☐	☒	☐	☒
☒ (included)	☒ (included)	☒ (via BBS)	☒ (via BBS)	☒ (included)	☒ (included)	☒ (included)	☐	☒ (included)
☒	☒	☒	☒	☐	☐	☒	☒	☐
8:00-6:00 M-F	8:00-6:00 M-F	8:00-5:00 M-F	8:00-5:00 M-F	9:00-6:00 M-F	9:00-6:00 M-F	8:30-5:30 M-F	8:00-6:00 M-F	10:00-6:00 M, 9:00-6:00 T-F
☒	☒	☒	☒	☒	☒	☒	☐	☒
5 years on printhead	1 year, five years on printhead	1 year	1 year	1 year	1 year	2 years	1 year	2 years



BUSINESSES ARE USING MICROSOFT ACCESS TO TRACK WORMS, MOVE PEOPLE, AND MAKE WISHES COME TRUE.

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"Our information was in a variety of locations: filing cabinets, notebooks, people's heads," recalls Bob Wolf, 3M Product Development Engineer. "The business problem we had was not being able to access our information effectively." They chose Microsoft Access to build their database of ideas, maintain mailing lists, generate surveys, and more. "It saves time in training, in building the databases, and it saves time in accessing the information." Which leaves more time to concentrate on turning wishes into the products people want.

Managing data and reporting are easier.

Scott Emmons, Professor of Molecular Genetics at Albert Einstein College of Medicine, spends a lot of time with worms. Thousands of them. As a basic research tool, nematode worms are a valuable part of learning how DNA forms the blueprint for life. For Scott, managing the variety of data associated with each different mutant worm strain—and being able to generate reports on his research quickly—is critical to keeping his lab running smoothly. He turned to Microsoft Access.

"A major part of the way I'm using Microsoft Access is the reports that I generate," says Scott. "I can sort the data a number of ways, and the ease of use means I can quickly scan these reports to locate a particular strain." And that means a lot less strain on Scott.

The uses are endless.

Intercity Transit in Olympia, Washington, recently moved from Paradox[®] because of the superior reporting capabilities in Microsoft Access, and its interoperability with other Microsoft applications. "To go with our suite of Microsoft[®] Office products, we felt it was the best choice for us," explains Richard Madrid, Intercity Transit MIS Specialist.

Today, Intercity Transit relies on Microsoft Access to keep them running—literally. By using it to maintain

and generate timetables for bus riders and drivers, they've all but eliminated scheduling errors, and saved countless hours of proofing and information-transfer time. Plus, they can track ridership by customer segment and keep tabs on the productivity of every route. Now they plan to use Microsoft Access to help grow their rideshare program.

"Microsoft Access has given us a lot of capabilities, not just report writing, but access to the data, and configuring it the way we need it for reporting and tracking," notes Richard. "Plus it's easy, so people are happy." And that's bound to keep Intercity Transit headed in the right direction.

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Now everyone can get access to data.

The Commercial Office Supply Division at 3M[®] is always on the lookout for new product ideas. After all, the next Post-it[™] note could be right around the corner. But until recently, they were missing a way to organize all of the "product wishes" floating around their department into a format everyone in the group could easily share and use.



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PRINTERS

Mainstream Lasers

► SUMMARY OF FEATURES

ENDS

Products listed in alphabetical order

■ = YES □ = NO

PC MAGAZINE
EDITORS' CHOICE

PC MAGAZINE
EDITORS' CHOICE

	Tandy LP400	Tandy LP410	Tandy LP800	TI microLaser Pro 600	TI microWriter	Xante Accel-a-Writer 4000	Xante Accel-a-Writer 8100
List price	\$799	\$1,099	\$1,499	\$1,599	\$799	\$1,795	\$3,995
Physical Characteristics							
Dimensions (HWD, in inches)	8 x 14.2 x 24.5	8 x 14.2 x 24.5	8.5 x 15.5 x 25.2	13 x 14.4 x 12.8	10.4 x 13.8 x 14.8	7.5 x 16 x 13.5	12 x 18 x 20.5
Weight (pounds)	29	29	32	32	33	22	51
Engine type	Laser	Laser	Laser	Laser	LED array	Laser	Laser
Engine model	TEC LB1321-LC	TEC LB1321-LC	TEC LB1323	Sharp JX-9660	Samsung	Canon LBP-LX	Canon LBP-BX
Maximum resolution in HP PCL (dpi)	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300	300 x 300
Maximum resolution in PostScript (dpi)	N/A †	300 x 300	300 x 300	600 x 600	300 x 300	600 x 600	1,200 x 1,200 *
RISC processor	N/A †	N/A †	N/A †	20-MHz IPT 3051	N/A †	16-MHz AMD Am29000	16-MHz AMD Am29000
Rated engine speed (pages per minute)	4	4	8	8	5	4	8
Single-cartridge toner/developer/drum	□	□	□	□	□	■	■
Toner capacity (images)	1,500	1,500	1,500	15,000	2,500	4,000	6,000
Standard, maximum RAM	512K, 2.5MB	1MB, 3MB	1MB, 5MB	6MB, 22MB	2MB, 4MB	8MB, 16MB	12MB, 64MB
Accepts standard SIMMs	■	■	■	□	□	■	■
Interfaces							
Parallel/serial port	■ ■	■ ■	■ ■	■ Optional	■ Optional	■ ■	■ ■
LocalTalk port	□	□	□	■	■	■	■
SCSI port for hard disk	□	□	□	Optional	□	■	■
Ethernet	□	□	□	Optional	Optional	□	Optional
Token-Ring	□	□	□	□	□	□	□
Automatic interface switching	□	□	□	■	□	■	■
Simultaneously active ports	□	□	□	■	□	■	■
Paper Handling							
Capacity of each standard input cassette (sheets)	100	100	250	250	250	50	250
Capacity of each standard output-tray (sheets)	100	100	100	250	200	50	250
Can print on B-size paper	□	□	□	□	□	□	■
Duplexing	□	□	□	□	□	Optional	Optional
Rated maximum paper weight (pounds)	32	32	32	34	34	28	32
Fonts and Features							
HP PCL support	PCL 4	PCL 5	PCL 5	PCL 5	PCL 4	PCL 4	PCL 4
Accepts HP-compatible font cartridges	■	■	■	□	□	□	□
PostScript language support	Optional (PageStyler)	Optional (PageStyler)	Optional (PageStyler)	Adobe PostScript Level 2	Adobe PostScript	PhoenixPage	PhoenixPage
Number of Type 1 fonts provided	N/A	N/A	N/A	23	23	35	35
Automatic emulation switching	□	□	□	■	■	■	■
Resolution enhancement	□	□	■	□	□	■	■
Printer-specific Windows 3.1 driver available	□	□	□	■ (included)	■ (included)	■ (included)	■ (included)
Customer Support							
Toll-free technical support	□	□	□	■	■	■	■
Telephone support hours (eastern time)	9:00-6:00 M-F	9:00-6:00 M-F	9:00-6:00 M-F	7:00-7:00 M-F	7:00-7:00 M-F	9:00-6:00 M-F	9:00-6:00 M-F
BBS	□	□	□	■	■	■	■
Warranty	1 year	1 year	1 year	1 year	1 year	1 year	1 year

N/A †—Not applicable The product does not have this feature N/A ‡—Not applicable This unit is not a PostScript printer

Mainstream Lasers

Lexmark International Inc.

IBM 4039 10R

IBM 4039 10R Duplex

BY HAL GLATZER

The 10-page-per-minute, 600-dot-per-inch IBM 4039 10R and IBM 4039 10R Duplex are worthy successors to the IBM LaserPrinter 10P, an Editors' Choice recipient last year. The IBM 4039 10R, which supports PCL 5 and Lexmark's own PostScript emulator, lists for \$1,599; the duplex model lists for \$2,199, making it one of the least expensive two-sided laser printers around. It also has one of the easiest-to-use control panels you'll find.



The IBM 4039 10R scored an impressive 9.1 ppm under PostScript emulation and 8.7 ppm under PCL 5 on our Text Speed test. Graphics speed was good under PCL 5 emulation but lagged in PostScript mode. The IBM printers produce 600-dpi output only under PostScript emulation. Though 300-dpi graphics were grainy and unimpressive, 600-dpi graphics were crisp.

The IBM 4039 10R Duplex can be purchased ready to run out of the box, or you can upgrade the standard IBM 4039 10R yourself with a \$699 duplex kit. Installing the kit is easy, although we initially encountered an insufficient-memory error that the manual didn't clearly explain how to resolve.

Performance in duplex mode was 6.3 ppm, the result of overhead while the duplexer flips the paper. Though the IBM 4039 10R itself is quiet, we found that the duplexing unit isn't so well muffled.

Street prices for the IBM 4039 10R and IBM 10R Duplex should be somewhere in the neighborhood of \$1,350 and \$1,900, respectively.

Whether you need two-sided output now or think you might sometime in the future, these models offer low-cost, high-speed solutions.

Lexmark International Inc., 740 New Circle Rd., Lexington, KY 40511-1847; 800-358-5835, 606-232-2000; fax, 606-232-5439.

IBM 4039 10R List price: \$1,599; 2MB RAM upgrade, \$199; 4MB RAM upgrade, \$299; 8MB RAM upgrade, \$499; font cards, \$239 each; 500-sheet legal-size cassette, \$359; 500-sheet letter-size cassette, \$349; 75-envelope cassette, \$349; 100-sheet multipurpose cassette, \$229;

200-sheet legal-size tray, \$79; 200-sheet letter-size tray, \$69; Ethernet 10BaseT adapter, \$439; LocalTalk adapter, \$299; Token-Ring adapter, \$649; duplex kit, \$699; toner/developer/drum unit, \$199. Emulations: Lexmark PostScript, PCL 5.

IBM 4039 10R

Duplex List price: \$2,199; options are same as IBM 4039 10R (except for duplex kit, which comes standard). Emulations: Lexmark PostScript, HP PCL 5. Circle 477 on reader service card

NEC Technologies Inc.

NEC Silentwriter SuperScript 610

BY GREG PASTRICK

The NEC Silentwriter SuperScript 610 is a GDI (Graphics Device Interface) printer that NEC estimates will sell on the street for \$650 to \$700. GDI printers convert Microsoft Windows' native graphics format directly into bitmaps, usually by using a software rasterizer on the host PC. This helps reduce hardware costs but also means that you can only print from within Windows.

The SuperScript 610 is a compact laser printer controlled by a software printing system that has its own print manager. A



PCL 4 driver is also included, but PCL-mode printing is available only from a Windows DOS session. PostScript emulation software is also available for \$99.

The printer relies on the host PC's resources for processing printer information, downloading fonts, and queuing jobs, so performance is dependent upon the host PC's memory, disk, and CPU. In particular, the SuperScript 610 uses Windows' virtual-memory capability for processing page and font information and spooling print jobs.

Since the unit prints only from within Windows, we don't report results for our standard PCL speed tests. And on our Windows applications tests under PCL emulation, it was an unexceptional performer. Performance was above average under PostScript emulation, however.

The printer has no external controls or display panel; its print manager provides access to basic control options and status screens. You can also select or deselect print operations using the Windows Print Manager. With the SuperScript print manager turned off, you get faster printing. Turn the print manager back on and you get a swift return to active applications.

The SuperScript 610 has an Energy Star-compliant power-saving mode that kicks in after the printer is idle for a user-defined period.

NEC Technologies Inc., 1414 Massachusetts Ave., Boxborough MA 01719; 800-388-8888, 508-264-8000; fax, 508-264-8265.

NEC Silentwriter SuperScript 610 Estimated street price: \$650 to \$700; NEC's SuperScript PostScript emulation software, \$99; 200-sheet tray, \$89; toner/developer/drum unit, \$115. Emulations: GDI, HP PCL 4.

Circle 478 on reader service card



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☐ IBM LaserPrinter 4039 (12 ppm)
☐ IBM LaserPrinter 4029 (10 ppm, 6 ppm)
☐ Calera WS Complete PC Scanner

SOFTWARE

Word processing ☐ Lotus Ami Pro ☐ Microsoft Word®
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PRINTERS

Mainstream Lasers

NewGen Systems Corp.

NewGen ImagerPlus 12

NewGen Turbo PS/660 B

NewGen Turbo PS/660p

BY BILL DYSZEL

NewGen Systems Corp.'s three new printers, all of which include NewGen's PostScript emulator, offer superb output quality. There's the impressive NewGen ImagerPlus 12, a 1,200-dot-per-inch B-size printer (\$7,495); the NewGen Turbo PS/660 B, a 600-dpi B-size printer (\$4,995); and the NewGen Turbo PS/660p, a 600-dpi personal printer (\$1,995).

The printers share an automatic emulation- and interface-switching feature, but it worked inconsistently on our tests. Also, all three NewGens were unable to complete our PCL tests because of driver incompatibility.

The Turbo PS/660p uses a 4-page-per-minute Canon LBP-LX engine but dem-



onstrated unusually strong PostScript performance for a low-cost personal printer. The unit includes 8MB of RAM (expandable to 32MB), as well as the 35 standard Type 1 PostScript fonts.

The 8-ppm Turbo PS/660 B (about \$4,100 on the street) uses a Canon BX print engine and 12MB of RAM (expandable to 96MB) to print on stock of up to 11 by 17 inches. A printer upgrade that boosts resolution to 1,200 by 600 dpi can be purchased for \$995.

The ImagerPlus 12 (about \$7,000 on

the street) provides 11- by 17-inch full-bleed output on paper that is up to 12 by 19.5 inches. A Toshiba engine, which requires a two-unit toner/developer, prints at up to 1,200 dpi. Graphics output from the ImagerPlus 12 was very impressive; lines were crisp and clean and image

contrast was excellent. PostScript performance was quite reasonable as well, thanks to the unit's Weitek XL-8220 controller and 40MB of memory (expandable to 96MB).

NewGen Systems Corp., 17550 Newhope St., Fountain Valley, CA 92708; 800-756-0556, 714-641-8600; fax, 714-641-2800.

NewGen ImagerPlus 12 List price: \$7,495; 1MB RAM upgrade, \$89; 2MB RAM upgrade, \$169; 4MB RAM upgrade, \$329; 8MB RAM upgrade, \$649;

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150-sheet multipurpose cassette, \$149; HP PCL 5 emulation, \$199; Ethernet interface, \$499; 80MB SCSI drive, \$399; drum kit, \$599; toner, \$49. Emulations: HPGL, HP PCL 4, NewGen PostScript.

NewGen Turbo PS/660 B List price: \$4,995; 1MB RAM upgrade, \$89; 2MB RAM upgrade, \$169; 4MB RAM upgrade, \$329; 8MB RAM upgrade, \$649; upgrade to 1,200- by 600-dpi, \$995; 80MB SCSI drive, \$399; HP PCL 5 emulation, \$199; 250-sheet legal-size paper cassette, \$99; 500-sheet letter- or A4-size cassette, \$89 each; multisize tray feeder assembly, \$499; Ethernet interface, \$599; toner/developer/drum unit, \$79. Emulations: HPGL, HP PCL 4, NewGen PostScript.

NewGen Turbo PS/660p List price: \$1,995; 1MB RAM upgrade, \$89; 2MB RAM upgrade, \$169; 4MB RAM upgrade, \$329; 8MB RAM upgrade, \$649; 80MB SCSI drive, \$399; HP PCL 5, \$199; paper cassette, \$69; lower assembly with 250-sheet paper cassette (letter-, legal-, A4, or executive-size), \$250; 20-envelope feeder, \$89; Ethernet interface card with SCSI interface, \$599. Emulations: HPGL, HP PCL 4, NewGen PostScript.

Circle 479 on reader service card

Okidata

Okidata OL400e

Okidata OL850

BY JOSEPH DESPOSITO

The Okidata OL400e and OL850 are aggressively priced LED page printers with basic features. The \$1,999 OL850 (street price, around \$1,399) offers true Adobe PostScript and 35 fonts. The PCL 4-compatible OL400e, a successor to the long-running OL400, targets value-sensitive buyers with its \$699 list price and street price of as low as \$499. Each printer employs an eight-button control panel with a 32-character LCD, and each has separate drum and toner components.

The 8-page-per-minute OL850 succeeds the OL840, employing a print engine from Okidata Electric and a Motorola 68000 processor. OKI Smoothing Technology enhances the printer's 300-dot-per-inch resolution, making its output superior to that of the OL400e.

The OL850 encountered minor cross-



The Okidata OL400e and OL850

hatching compatibility problems in HP PCL 4 mode; otherwise, it worked flawlessly. It tested faster than its rated speed on the Text Speed test in HP PCL 4 emulation, and performed faster than average among 8-ppm printers on our Graphics Speed test.

The 4-ppm OL400e departs from the earlier OL400 models both in exterior design and print engine. At only 17 pounds, the new unit is lightweight and has a small footprint of 9.5 by 12.6 by 19.5 inches (HWD). Inside, it uses a new

and legal-size paper. A new power-saving mode used only 10 watts on our Power Consumption test when the printer was idle.

The OL400e encountered the same cross-hatching problems as the OL850; otherwise, it too worked flawlessly. The OL400e was slightly faster than average on our Graphics Speed test and tested faster than its rated speed on the Text Speed test in HP PCL 4 emulation.

Okidata, 532 Fellowship Rd., Mt. Laurel, NJ 08054; 800-654-3282, 609-235-

Okidata Electric engine and a MIPS R3000 RISC processor.

The OL400e has four typefaces in various sizes and U.S. Postal Service Postnet bar codes. An adjustable paper cassette holds up to 100 sheets and a manual feed takes labels, envelopes,

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2600; fax, 609-778-4184.

Okidata OL400e List price: \$699, 1MB RAM upgrade, \$119; additional 1MB memory chips, \$55 each; font cards, \$149 to \$229 each; 100-sheet letter/universal paper cassette, \$75; 100-sheet legal/universal paper cassette, \$85; drum kit, \$189; toner, \$29. Emulations: HP PCL 4.

EDITORS' CHOICE ► Okidata OL850 List price: \$1,999; 2MB RAM upgrade, \$399; font cards, \$195 to \$395 each; 200-sheet paper cassettes (letter-, legal-, executive-, and A4-size), \$89 each; 200-sheet universal paper cassette, \$109; second story/second paper tray mechanism, \$329; 15-envelope feeder, \$89; drum kit, \$289; toner, \$33. Emulations: Adobe PostScript, Diablo 630, HP PCL 4. Circle 480 on reader service card

Panasonic Communications & Systems Co.

Panasonic KX-P4440

Panasonic SideWriter KX-P5400

BY GREG PASTRICK

The \$999 Panasonic SideWriter KX-P5400 stands upright like a tower PC, giving it the smallest footprint by far of the 35 laser printers we tested. Based on a 4-page-per-minute Panasonic engine, the KX-P5400 offers 300-dot-per-inch resolution, PCL 4 compatibility, and a true Adobe PostScript Level 2 interpreter. (By the time you read this, an HP PCL 4-only version, the SideWriter KX-P4400, will also be available for a list price of \$649.) The \$1,449 Panasonic KX-P4440, a 300-dpi PCL 5 printer built around a 10-ppm Panasonic engine, has a more traditional design. Both models support a power-saving mode, which

kicks in after a programmable interval and cuts power draw to under 20 watts.

The KX-P5400's unusual design keeps its dimensions down, though it also involves some minor compromises. The parallel interface and cables jut out from the lower-right front of the printer, rather than being hidden at the rear. The unit we tested also leaked toner. While that might have been because we frequently moved the unit, it's a concern given the KX-P5400's near-portable design.

At a street price that will be well under \$1,000, the KX-P5400 is one of the least expensive and least obtrusive personal PostScript printers you can find. Flipping open on the right side of the printer, the 100-sheet paper cassette adds just under 6 inches to the printer's 4.75-inch width. The fold-out output tray at the top of the printer can accommodate 50 sheets. The KX-P5400 comes with 2MB of RAM (expandable to 4MB). There's just enough room inside the case for a fax option (\$499), which also adds 18 fonts to the 17 that are standard in the base unit.

The unit's performance was slightly above its 4-ppm rated speed on text, but near the bottom of the pack printing graphics. Output quality was average.

Panasonic's other new laser printer, the KX-P4440, is a 300-dpi unit with 22 built-in fonts and Diablo 360, HP PCL 4, HP PCL 5, and IBM Proprinter emulations. The unit's standard 1MB of RAM can be expanded to 5MB. The printer doesn't include a resolution-enhancement feature, so fine lines tend to have a jagged look.

The KX-P4440's performance on our Graphics Speed test was only average despite its speedy engine; on our Text Speed test, it turned in a strong 9.1-ppm score.

With a \$1,250 street price, the KX-P4440 is best-suited for text-heavy printing needs.

Panasonic Communications & Systems Co., Two Panasonic Way, Secaucus, NJ 07094; 800-742-8086; fax, 201-392-4500.

Panasonic KX-P4440 List price:

\$1,449; 2MB RAM upgrade, \$259; serial interface, \$109.95; drum kit, \$159; toner, \$54; developer, \$189. Emulations: Diablo 630, HP LaserJet III, IBM Proprinter.

Panasonic SideWriter KX-P5400 List price: \$999; 2MB RAM upgrade, \$259.95; Adobe PostScript fax option, \$499; LocalTalk interface, \$249.95; serial interface, \$109.95; drum kit, \$89.95; toner, \$17.95. Emulations: Adobe PostScript Level 2, HP PCL 4.

Circle 481 on reader service card

QMS Inc.

QMS 420 Print System

QMS 860 Print System

BY JOSEPH DESPOSITO

Both the QMS 860 Print System and the QMS 420 Print System laser printers feature excellent 600-dot-per-inch print quality. The QMS 860, at \$4,595 (street price, \$3999), is a notch better, thanks to ultrafine toner used by its Canon LBP-BX engine. The QMS 860 targets shared computing environments, while the QMS 420, at \$1,995 (street price, \$1559), targets single users and small workgroups.

Both models include 39 Adobe compatible Type 1 typefaces, and both support Adobe PostScript Levels 1 and 2, HPGL, and HP PCL 4 emulations. Both printers also perform emulation sensing and have simultaneously active parallel, serial, and LocalTalk ports.

An 8-page-per-minute printer, the QMS 860 includes a 250-sheet paper cassette and a 100-sheet adjustable tray. It can accommodate 11- by 17-inch paper using an oversized paper cassette (\$99). The QMS 860 scored close to its rated pages per minute on the Text Speed test, but did not distinguish itself on the Graphics Speed test.

The QMS 420 is a 4-ppm printer built around a Canon LBP-LX engine and equipped with a 70-sheet paper cassette. On the Graphics Speed test it was noticeably slower than the QMS 860 in Adobe PostScript emulation.

QMS Inc., One Magnum Pass, Mobile, AL 36689-1250; 205-639-4400; fax, 205-633-4866.

QMS 420 Print System List price: \$1,995; 4MB RAM upgrade, \$459; 8MB RAM up-





grade, \$799; DEC LN03+ emulation, \$395; HP ProCollection font card, \$295; 250-sheet letter- or A4-size paper cassette, \$69; 250-sheet legal- or executive-size paper cassette, \$79; 250-sheet lower paper cassette, \$195; 20-envelope cassette, \$89; toner, \$95. Emulations: HPGL, HP PCL 4, QMS PostScript, QMS PostScript Level 2.

EDITORS' CHOICE ► QMS 860 Print System List price: \$4,595; 4MB RAM upgrade, \$459; 8MB RAM upgrade, \$799; 45MB hard disk, \$1,195; DEC LN03+ emulation, \$495; HP ProCollection font card, \$295; 250-sheet paper cassettes (letter-, legal-, A3-, A4-, B-, B4-, or B5-size or B-oversize), \$99 each; 500-sheet letter- or A4-size cassette, \$129 each; 250-sheet multipurpose paper feeder, \$495; 500-sheet paper supporter, \$89. Connectivity options: DECnet TCP/IP, \$1,395; Ethernet TCP/IP, \$1,095; EtherTalk, \$895; NetWare Ethernet, \$895; NetWare Token-Ring, \$1,095; CCITT group 4 fax card, \$295; system security card, \$250; toner/developer/drum unit, \$189. Emulations: HPGL, HP PCL 3, HP PCL 4, QMS PostScript, QMS PostScript Level 2.

Circle 482 on reader service card

Samsung Electronics America Inc.

Samsung Finalé Hi-Res

BY BRUCE BROWN

Based on the Samsung F-8000 8-page-per-minute laser engine, the Samsung Finalé has a \$2,068 list price and \$1,500 street price. The Hi-Res part of the Samsung printer's name comes from its effective 1,200-dot-per-inch printing in Adobe PostScript mode. Samsung divides each 300-dpi dot into four quadrants and can

address any one of four positions in each quadrant. The printer also includes Samsung Resolution Technology for smoothing jagged curves in graphics and text. In PostScript printing, the effective 1,200-dpi mode shows in high-quality graphic print samples with sharp,

clean lines and excellent contrast ratios. Thirty-nine PostScript fonts are included in addition to 14 bitmap and 8 scalable PCL fonts. The Finalé also contains its own TrueType rasterizer in firmware, eliminating the need for font substitution in Windows or TrueType rasterization using software.

The Finalé Hi-Res proved speedy, especially in text printing, with text speeds of 7.2 ppm in PostScript mode and 7.5 ppm in HP PCL mode. HP PCL images printed at a rate of 2.4 graphics pages per minute and PostScript images printed at 0.4 gppm.

Samsung Electronics America Inc. Information Systems Division, 105 Challenger Rd., Ridgefield Park, NJ 07660; 800-446-0262, 201-229-4000; fax, 201-229-4110.

Samsung Finalé Hi-Res List price: \$2,068; 2MB RAM upgrade, \$265; 4MB RAM upgrade, \$349; 8MB RAM upgrade, \$499; 250-sheet letter-size paper cassette, \$69; 250-sheet legal or A4-size cassettes, \$40 each; LocalTalk upgrade kit, \$129; drum kit, \$159; developer, \$249; toner, \$79. Emulations: Adobe PostScript, Epson FX 850, HPGL, HP PCL 4, HP PCL 5, IBM Proprinter.

Circle 483 on reader service card



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Sharp Electronics Corp.

Sharp JX-9400

BY BRUCE BROWN

If money, space, and time are tight, the Sharp JX-9400 is worth a look. The JX-9400 takes up a mere 1.3 square feet of desk space, has a list price of only \$599, and consistently prints text pages faster than its 6-page-per-minute rating. Street price is a low \$499.

The JX-9400 is at the low end of the company's laser product line. Most users will stick with the fully compatible HP PCL 4 emulation (with 14 internal bitmap fonts), although the printer also has Diablo 630, Epson FX, IBM Graphics Printer, and IBM Proprinter emulations. A single paper cassette holds 250 sheets.

In speed testing, the performance of the JX-9400 was mixed. The Text Speed test result was a speedy 6.6 ppm, but graphics printing tested at 0.9 gppm in HP PCL 4 mode, which is on the slow side for a 4- to 6-ppm printer. Print quality in both modes was very good: Lines were sharp and contrast was acceptable, given the printer's 300-dot-per-inch resolution.

Sharp Electronics Corp., Sharp Plaza, Mahwah, NJ 07430; 800-526-0522, 201-529-9593; fax, 201-529-9637.

Sharp JX-9400 List price: \$599; 1MB RAM upgrade, \$141; 2MB RAM upgrade, \$229; 4MB RAM upgrade, \$457; 10-font cartridges, \$195 to \$275 each; 250-sheet letter-size or A4-size paper cassettes, \$59 each; 250-sheet legal-size paper cassette, \$70; 20-envelope cassette, \$157; drum kit, \$190; toner/developer cartridge, \$210. Emulations: *Diablo 630, Epson FX, HP PCL 4, IBM Graphics Printer, IBM Proprinter.*

Circle 484 on reader service card



Star Micronics America Inc.

Star Micronics LS-5EX

BY BRUCE BROWN

Based on a Fuji Xerox 5-page-per-minute laser engine, the Star Micronics LS-5EX, which lists for \$989 and should be available on the street for \$150 to \$200 less, is a good choice in situations where budget and printing demands don't justify spending more on an 8-ppm printer.

With standard HPGL, HP PCL 4, and HP PCL 5 emulations; 14 bitmapped and 8 scalable Intellifonts; and 15 TrueType typefaces, the LS-5EX is fully equipped for most text printing needs. An Adobe PostScript-compatible emulation cartridge (\$225) is also available.

The LS-5EX uses a convenient and clean one-piece toner, developer, and drum combination that is good for 4,500 sheets. The printer's monthly duty cycle



is 3,000 pages, with a 150,000-sheet life expectancy. Performance was reasonable with 4.1-ppm text and 1.7-graphics-pages-per-minute HP PCL 4 graphics printing speeds. Text and graphics quality were good, although contrast was not as defined as with some other printers we examined in this roundup.

A 50-sheet fold-down universal paper tray and a 250-sheet universal paper cassette come standard with the printer, so you can keep letterhead in the tray and blank sheets in the cassette. A third 500-sheet lower paper cassette is an option that costs \$305.

Star Micronics America Inc., 420 Lexington Ave., #2702, New York, NY 10170; 800-447-4700; 212-986-6770; fax, 908-572-4004.

Star Micronics LS-5EX List price: \$989; 1MB RAM board, \$155; 2MB RAM

board, \$275; 1MB RAM module, \$130; 2MB RAM module, \$245; PostScript PDL and TrueImage emulation cartridge, \$225; 500-sheet letter-size paper cassette, \$165; 250-sheet legal-size paper cassette, \$110; 250-envelope feeder, \$110; 250-sheet universal paper cassette, \$65; second sheet feeder, \$305; toner cartridge, \$95. Emulations: *HPGL, HP PCL 4, HP PCL 5.* Circle 485 on reader service card

Tandy/Radio Shack Corp.

Tandy LP400

Tandy LP410

Tandy LP800

BY BRUCE BROWN

Ranging in base price from \$799 to \$1499, the Tandy LP400, LP410, and LP800 printers offer a clear progression of features and printing speeds.

Based on Tokyo Electronic Corp. (TEC) laser printing engines, the Tandy printers all use three-piece consumables, with separate toner, drum, and developer units. The front-panel 16-character LCD screens, raised buttons, and clear configuration menus make printer operation simple.

The entry-level \$799 Tandy LP400 4-page-per-minute laser printer comes with 512K of RAM (expandable to 2.5MB), HP PCL 4 compatibility, and 14 bitmap fonts. Performance was above average, with a rate of 3.9 ppm on the HP PCL Text Speed test and 1.3 graphics pages per minute on our Graphics Speed test. Text output was reasonably crisp and dark, and graphics output was also good, with minor banding in gray-level tests.

If you want more features than are available with the Tandy LP400 but you don't need faster printing, the Tandy LP410 is a very good deal at \$1,099. The LP410 raises the ante with 1MB of RAM (3MB maximum), HP PCL 5 compatibility, 8 scalable fonts in addition to the 14 bitmap fonts, Tandy's Edge Enhancement Technology (EET) for fine images, additional Epson FX and IBM Proprinter emulations, and an optional Adobe PostScript-compatible PageStyler PDL cartridge PostScript emulation (\$399.99).

The LP410 printed text at the same

PRINTERS

Mainstream Lasers



The Tandy LP800, LP400, and LP410

3.8-ppm rate as the LP400 on our Text Speed test and was faster on the Graphics Speed test in HP PCL 4 mode with a score of 1.6 gppm. The LP410's overall image output quality was better than that of the LP400 but still showed slight banding and waviness in the graphics print samples.

The top of Tandy's personal page printer line, the 8-ppm LP800, lists for \$1,499 with 1MB of RAM and all the features of the LP410. Other than its faster laser engine (which tested at 7.8 ppm in text printing and 2.4 gppm in graphics

76102; 817-390-3011.

Tandy LP400 List price: \$799; 1MB RAM upgrade, \$199.99; second bin 300-sheet paper feeder, \$249.99; drum kit, \$119.99; developer, \$159.99; toner, \$23.99. Emulations: HP PCL 4.

Tandy LP410 List price: \$1,099; 1MB RAM upgrade, \$199.99; PageStyler PDL cartridge PostScript emulation (requires 3MB), \$399.99; second 300-sheet paper feeder, \$249.99; drum kit, \$119.99; developer, \$159.99; toner, \$23.99. Emulations: Epson FX, HP PCL 4, HP PCL 5, IBM

printing in HP PCL 4 mode), the LP800 differs from the LP410 only in its higher maximum memory (5MB), larger paper capacity, and two HP-compatible cartridge slots.

Tandy/Radio Shack Corp., 1500 One Tandy Center, Fort Worth, TX

Proprinter.

Tandy LP800 List price: \$1,499; 1MB RAM upgrade, \$199.99; 2MB RAM upgrade, \$399.99; Pagestyler PDL cartridge PostScript emulation (requires 3MB), \$399.99; second 300-sheet feeder, \$249.99; drum kit, \$119.99; developer, \$159.99; toner, \$23.99. Emulations: Epson FX, HP PCL 4, HP PCL 5, IBM Proprinter. Circle 486 on reader service card

Texas Instruments Inc.

TI microWriter

TI microLaser Pro 600

BY BILL DYSZEL

Texas Instruments introduces two new products, the TI microWriter (\$799 for the basic PostScript version), aimed at the budget-minded, and the \$1,599 TI microLaser Pro 600, targeted at high-quality graphics printing assignments.

The TI microLaser Pro 600 offers PostScript level 1 (with 23 fonts) and HP PCL 5 (with 8 Intellifonts) emulations

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CIRCLE 378 ON READER SERVICE CARD

PRINTERS

Mainstream Lasers

and should be available on the street for about \$1,300. The 8-page-per-minute Sharp JX-9660 print engine produces true 600-dot-per-inch output. Automatic emulation switching worked smoothly on our printer tests, as did automatic switching between the high-speed parallel port and LocalTalk port, which comes standard. Print quality was excellent, showing almost no distortion at small type sizes, no waviness in thin rules, and only slight banding in gray-scale output. Two built-in 250-sheet paper cassettes are included in the basic configuration.

The TI microWriter is a reliable, easy-to-use Adobe PostScript-, HP PCL 4-compatible printer available in three versions: one with 23 Adobe PostScript fonts (\$799 list price, about \$700 street price), one with 65 PostScript fonts (\$1,099 list price, \$975 street price), and one that only supports HP PCL 4 (\$599 list price, \$529 street price).

Both PostScript versions have a LocalTalk interface along with the usual Centronics parallel port, but automatic interface switching is not available. Automatic

emulation switching between HP PCL 4 and Adobe PostScript is built in, and worked seamlessly on our tests. The LED print engine scored 4.5 pages of text per minute and 0.5 gppm in PostScript mode, and offered good quality, although graphics compatibility tests for HP PCL 4 showed some slight distortions.

The built-in 250-sheet paper cassette worked smoothly, while the manual paper cassette that comes with the microWriter for envelopes and nonstandard paper does not attach firmly enough to the printer to keep it from falling off. For those users who frequently print envelopes and various sizes of paper, the problem can be solved with a \$99 optional adjustable paper cassette. A second paper cassette can be added to the bottom of the printer, and the

driver software allows for the intelligent switching between cassettes for the use of letterhead paper and blank pages.

Texas Instruments Inc., P.O. Box 200230, Austin, TX 78720; 800-527-3500, 817-771-5856; fax, 817-774-6751.

EDITORS' CHOICE ▶ **TI microWriter** List Price: \$599 (HP PCL 4 only), \$799 (23 Adobe PostScript fonts and LocalTalk included), \$1,099 (65 Adobe PostScript fonts and LocalTalk included); 1MB upgrade, \$99; 2MB upgrade, \$199; 4MB upgrade, \$299; 8MB upgrade, \$349;



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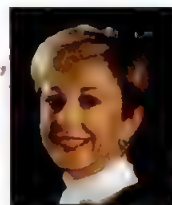


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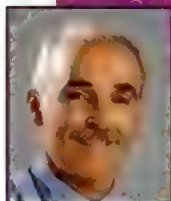
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Mainstream Lasers

250-sheet letter- or legal-size paper cassettes, \$49 each; executive 150-sheet paper/30-envelope cassette, \$99; imager kit (contains developer and OPC drum), \$169; toner kit, \$49. Emulations: Adobe PostScript, HP PCL 4.

EDITORS' CHOICE ▶ TI micro-Laser Pro 600 List price: \$1,599; 1MB upgrade, \$119; 2MB upgrade, \$199; 4MB upgrade, \$299; 8MB upgrade, \$599; 250-sheet letter- or legal-size paper cassettes, \$79 each; 250-sheet A4-size cassette, \$69; 30-envelope feeder, \$109; executive 150-sheet paper/30-envelope cassette, \$99; Ethernet, \$599; OPC drum cartridge, \$179; imager cartridge (contains developer and toner), \$199. Emulations: Adobe PostScript levels 1 and 2, HP PCL 4, HP PCL 5.

Circle 487 on reader service card

Xante Corp.

Xante Accel-a-Writer 4000

Xante Accel-a-Writer 8100

BY GREG PASTRICK

The \$1,795 Xante Accel-a-Writer 4000 and \$3,995 Xante Accel-a-Writer 8100 are strong candidates for high-end graphic arts and desktop publishing applications. Both offer 600-dot-per-inch output and PhoenixPage PostScript compatibility in addition to HP PCL 4 emulation. The 4-page-per-minute Accel-a-Writer 4000 comes with 8MB of RAM; the Accel-a-Writer 8100 is an 8-ppm B-size model that comes with 12MB of RAM and is upgradable to 1,200- by 1,200-dpi resolution.

The Accel-a-Writer 4000 has a 100-sheet paper cassette and a 50-page fold-down output tray. As tested, the printer had 12MB of RAM (a \$300 upgrade, \$2,095 total). Even so, its performance was only average among 4-ppm printers. Text output was very crisp, and graphics output showed good tonal range, although some jaggies were evident in fine lines.

The Accel-a-Writer 8100 accommodates paper up to 11 by 17 inches. By upgrading memory and clock crystals, you can boost resolution to 800- by 800-dpi, 960- by 960-dpi, or 1,200- by 1,200-dpi in PostScript emulation.

The Accel-a-Writer 8100's performance was about average, although output quality in 1,200-dpi mode was exceptional, approaching continuous-tone quality on half-tone images. Upon close examination, though, some vertical banding was evident. By the time you read this, the Accel-a-Writer 8100 will be shipping with PhoenixPage Level 2 support, according to Xante Corp.

Both printers are driven by AMD 29000 RISC processors and can take advantage of Xante's 512K Virtual Disk upgrade (\$100), which lets you permanently store downloaded fonts. A SCSI port also lets you attach a hard disk.

Although Xante claims that the Accel-a-Writers are not usually discounted, we were able to find the Accel-

a-Writer 8100 for just under \$4,000. The Accel-a-Writer 4000 costs more than other printers with similar features, but the Accel-a-Writer 8100 is an excellent value for a high-resolution B-size printer with plenty of expandability options. □

Xante Corp.,
2559 Emogene St.,
Mobile, AL 36606;
800-926-8839,
205-476-8189; fax,
205-476-9421.

Xante Accel-a-Writer 4000 List price: \$1,795; 4MB RAM, \$300; 512K virtual disk upgrade, \$100; 250-sheet paper cassette, \$195. Emulations: HP



PCL 4, PhoenixPage PostScript.

Xante Accel-a-Writer 8100 List price: \$3,995; 4MB RAM, \$300; 16MB RAM, \$1,200; 800-dpi upgrade (with 8MB RAM), \$600; 960-dpi upgrade (with 20MB RAM), \$1,500; 1,200-dpi upgrade (with 36MB RAM), \$2,700; 512K virtual disk upgrade, \$100; 250-sheet paper cassettes (letter- or legal-size, or 11- by 17-inch), \$89 each; paper feeder, \$395; cassette supporter, \$69. Emulations: HP PCL 4, PhoenixPage PostScript. Circle 488 on reader service card

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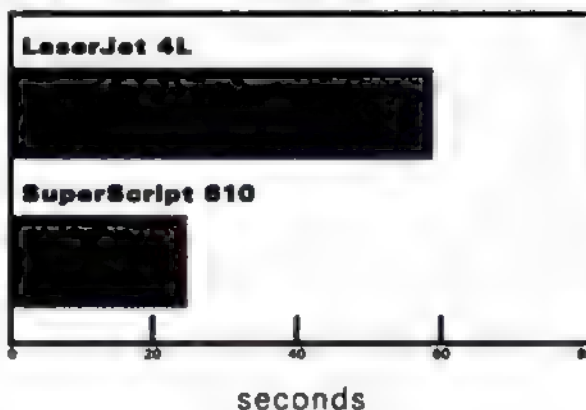
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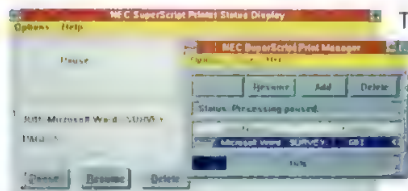
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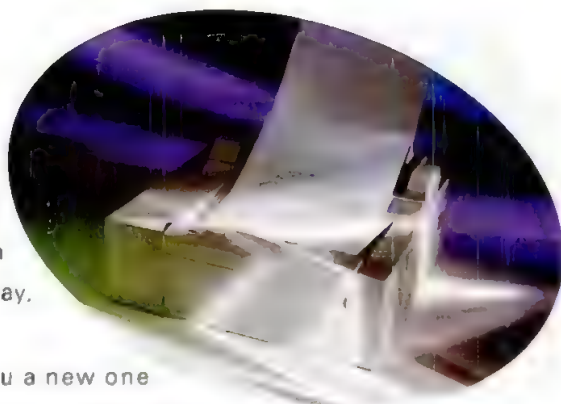
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Network Lasers *Built for Speed*



If you're looking for a workgroup printer that's networkable, that's rated for 12- to 30-page-per-minute operation, and that offers flexible paper handling, these 13 lasers deliver the goods.

There is no such thing as the perfect network printer. Not yet, anyway. More than any other laser printer category, the shared laser printer is still evolving—from what was formerly just a high-speed, high-volume workhorse toward a total network printing solution.

Most printers intended for shared use now either come with or offer optional network interface cards, allowing a direct connection as a live node anywhere on the network. A direct network connection eliminates the need to locate the printer close to a PC dedicated as a print server or file server. It also transfers data to the

printer much faster than a standard parallel port, and allows for bidirectional communication, so status and error messages can be sent back to the user or administrator at the PC.

This year 12 of the 13 network printers reviewed either came with network interface cards (NICs) or offered them as an option; last year, only 9 out of 16 did so. All of the NICs tested here come with utilities that allow varying degrees of remote printer management. Depending on the printer, a network user at his or her workstation can be notified of paper jams, empty paper trays and toner cartridges, open printer covers, and other problems that once required a walk

by James Karney

► IN THIS REVIEW

<i>Compaq PageMarq 20</i>	210	<i>IBM LaserPrinter 4039 16L</i>	224
<i>Genicom Model 7150</i>	210	<i>Output Technology LaserMatrix</i>	
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<i>IBM LaserPrinter 4039 12R</i>	224	<i>QMS 3225 Print System</i>	230

down the hall. The Compaq PageMarq 20; the HP LaserJet 4Si MX; the IBM LaserPrinter 4039 12L, 12R, and 16L; and the QMS 1725, 2025, and 3225 Print Systems even allow administrators to modify the control panel, download fonts, and print status reports from a workstation.

To varying degrees, all of the printers here can function in mixed environments, whether it means switching between Adobe PostScript and HP PCL emulations or receiving jobs simultaneously on different ports connected to different network operating systems (NOSs). The HP LaserJet 4Si MX leads here, with the ability to switch among ten NOSs.

MORE FEATURES, LOWER PRICES

As their network-specific features multiply, however, shared laser printers are becoming increasingly budget-friendly. According to BIS Strategic Decisions, prices for 12- to 20-page-per-minute printers have dropped an average of about 30 percent over the past year. The result: Buyers are looking for more options and can afford more performance. Sales of 12- to 20-ppm printers rose 40 percent this year—twice as much as the robust low end (under 7-ppm) laser market. Meanwhile, sales of 7- to 11-ppm printers fell slightly.

A few of the printers reviewed in this section save you money after the purchase as well. The three IBM LaserPrinters were the only shared laser printers we tested that conform to the Environmental Protection Agency's Energy Star Computers program, which requires power saving modes that consume 30 watts for 8- to 14-ppm laser printers and 45 watts for those that print at 15-ppm and above. The typical 12- to 20-ppm laser printer uses about 100 watts of power at rest and averages more than 300 watts while printing, peaking at as much

as 1,000 watts when the fuser is fixing the toner to the page. In idle mode, the Lexmark-manufactured IBM LaserPrinters powered down to about 18 watts.

While it doesn't currently meet Energy Star requirements, the Kyocera Ecosys a-Si Printer FS-3500A uses another approach to lower the total cost of ownership. It is the only printer in this entire issue whose drum lasts virtually the lifetime of the printer. The only real con-

sumable that needs periodic replacing is the toner, which contains microfine particles that continuously clean, polish, and recondition the drum. A \$49 toner cartridge is good for 6,000 pages, which results in a per-page cost of 0.8 cents, compared with the 2- to 3-cent per-page printing cost of the average 12- to 20-ppm laser printer.

PAPERLESS OFFICE? NOT!

Cost and network-specific capabilities are not the only factors to consider when shopping for a shared laser. You should also look for a high rated monthly duty cycle and hefty, flexible paper handling. Try to match the printer's rated monthly duty cycle to your expected maximum monthly load, and factor in some room for growth and for extra-volume crunch periods. The QMS Print Systems and the Printronix L3030 Duplex offer the high-

HIGHLIGHTS Network Lasers

FAST LASER PRINTERS—12 ppm and up—are usually destined for network use. With that in mind, the emphasis in this section is on features that make shared printing and network printer administration easier.

FLEXIBLE PAPER HANDLING is one important criterion, and the reviewed units offer plenty of choices. Four provide B-size (11- by 17-inch) output capabilities; most have paper feeders that can hold 1,000 or more sheets in various combinations; and ten units support two-sided (duplex) printing, either standard or as an option. The Output Technology LaserMatrix 1000 Model 6 uses perforated fanfold paper, just like a dot matrix printer.

NETWORK INTERFACE CARDS are the best bet for connecting your laser printer to a network. Benefits include faster throughput and better status reporting than you will get from a Centronics parallel connection, and freedom to locate the printer at virtually any distance from your server. Twelve of the thirteen units that we

reviewed in this section can be outfitted with internal NICs.

EMULATION SENSING lets the printer determine whether incoming jobs are formatted in HP PCL or Adobe PostScript and handle them accordingly. The best designs keep downloaded fonts resident, rather than reloading them after every emulation change.

REMOTE MANAGEMENT and easy setup are both strengths of the HP LaserJet 4Si MX. HP JetPrint software lets you configure the printer and check on its operating status from a remote workstation.

LIFETIME OPERATING COSTS are addressed directly by only two of the reviewed manufacturers. Lexmark International's three IBM LaserPrinters comply with the EPA Energy Star Computers guidelines for reduced power consumption. The Kyocera Ecosys a-Si Printer FS-3500A offers by far the lowest per-page cost around—0.8 cents—by using a drum that lasts the life of the printer.

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est rated duty cycle—up to 200,000 pages per month—while the Output Technology LaserMatrix 1000 Model 6 is rated lowest, at a still respectable 25,000 pages per month.

High-capacity paper handling saves trips down the hall to refill paper trays. The Compaq PageMarq 20 is the leader here, with three letter-size motorized paper trays that each contain two stacks of 250 sheets. When one stack is used up, the second moves automatically into place. Printers from Hewlett-Packard, Printronix, and QMS also accommodate optional feeders that can hold up to 1,500 sheets. Most printers offer optional multipurpose feeders for labels, envelopes, and other specialized media as well.

If you need to print on B-size paper, you can choose between the Genicom Model 7150, a no-frills B-size laser printer priced at only \$3,979, the Compaq PageMarq 20, which offers a B-size tray as an option, and the monster-size QMS 2025 and 3225 Print Systems, priced at \$12,995 and \$19,995, respectively. Four of the printers reviewed in our mainstream laser printer section also offer B-size output at 8 ppm.

Duplexing allows you to print on both sides of a page. Since paper adds about 1 cent to the per-page cost of laser output, duplexing can produce a significant savings over the life of the printer. Hewlett-Packard, Kyocera Electronics, Lexmark International, and QMS offer duplexing as an option. The Printronix L3030 Duplex we tested came with duplexing capabilities installed.

USER REQUIREMENTS

If you work in an office that mainly produces reams of text, you can probably manage with a printer that offers only PCL compatibility. But if users will be working with many different types of software, you should probably get a printer that supports HP PCL 5 and Post-



EDITORS' CHOICE

- *Moderate duty (letter-size)* **HP LaserJet 4Si MX**
- *Moderate duty (tabloid-size)* ... **Compaq PageMarq 20**
- *Heavy duty (tabloid-size)* **QMS 3225 Print System**

Shared laser printers are becoming more and more versatile even as their prices continue to fall. It's not enough anymore to offer high speed and hefty paper handling; a true network printer must now be able to

switch effortlessly between interfaces, emulations, and sometimes even network operating systems. It must be easy to set up and maintain, and should enable the administrator to detect problems and change default settings from his or her desktop PC. Many of these 12-page-per-minute and faster printers are up to the challenge.

The 17-ppm HP LaserJet 4Si MX is one of the most versatile of the 13 printers we tested—yet its list price is a reasonable \$5,499. The LaserJet 4Si MX comes with a flexible network interface and switches automatically between its included Adobe PostScript Level 2 and HP PCL 5 emulations. The HP JetPrint

and JetAdmin utilities let you control every aspect of the printer's configuration from a remote workstation.

The LaserJet 4Si MX produces resolution-enhanced 600-dot-per-inch output under both PCL and PostScript, and has plenty of paper-handling options. All it lacks is tabloid (B-size) output.

PAGEMARQ: STILL A LEADER

An Editors' Choice in last year's Printer Blockbuster, the Compaq PageMarq 20 still looks impressive a year later. The \$3,599 (estimated selling price) PageMarq doesn't offer all the advanced remote-management features of the LaserJet 4Si MX, but it comes close,

Script. Most of the printers reviewed here included some form of both in their base configuration. On the Printronix L3030 Duplex, however, HP PCL 5 support is optional. PostScript is an added expense with the HP LaserJet 4Si, Kyocera Ecosys, and Printronix L3030 Duplex.

If producing graphics or extremely high-quality text is an important part of your workload, then high resolution and image enhancement (imaging techniques that provide smoother lines and finer halftones) are essential. Of the units tested, the HP LaserJet 4Si (600-dpi resolution with image enhancement in PCL) and 4Si MX (600 dpi with image enhancement in PCL and PostScript) lead the

pack in terms of output quality.

Another feature to consider if your workgroup is graphics-oriented is a hard disk for storing fonts and logos on-line. This can speed up printing by cutting down on the time it normally takes to download fonts with each print job. The QMS and Compaq printers come with built-in hard disks. If you anticipate that the printer you buy will be switching emulations frequently, then consider the HP LaserJet 4Si MX and the QMS 1725, 2025, and 3225 Print Systems. These units store fonts, forms, macros, and dictionaries in memory when switching emulations so that they can retrieve this information quickly for later print jobs.

If your users' printing needs are confined to forms and labels, you should consider the Output Technology LaserMatrix unit, which combines laser printing with a tractor-feed mechanism and offers forms-specific features as well, such as vertical image registration to 1/150 inch, user control of fuser temperature in order

If users will be working with many different types of software, you should probably get a printer that supports HP PCL 5 and Adobe PostScript emulations.

and it offers B-size output with just the addition of an \$89 paper cassette.

The PageMarq supports automatic emulation switching between PCL 5 and true PostScript Level 2. Under PostScript, the printer offers full 800-by-400-dpi, resolution-enhanced output; under PCL, resolution tops out at 300 by 300 dpi. The PageMarq's three expansion slots take optional network interface cards or a PostScript fax board. Each NIC comes with a remote-management utility.

Paper handling is the PageMarq's forté. Three standard letter-size paper cassettes can each accommodate two stacks of 250 sheets. When one stack empties, the other one moves automatically into place. You can also substitute a single 250-sheet B-size tray for one of the letter-size trays.

MAXIMUM SPEED

For extremely high-volume network printing, consider the 32-ppm, B-size QMS 3225 Print System. Its rated monthly duty cycle of 200,000 pages is far larger than the PageMarq's 50,000

and LaserJet's 75,000 pages—as is its \$19,995 list price. The QMS 3225 is a mega-size workhorse that comes standard with 16MB of RAM and offers PostScript and PCL 5 compatibility at 400-dpi and 300-dpi resolutions, respec-

*Paper handling is the
PageMarq's forte. Three
standard letter-size paper
cassettes can each
accommodate two stacks
of 250 sheets.*

tively. The QMS 3225 lacks any form of resolution enhancement.

QMS Crown architecture leads the pack in simultaneous processing of multiple print jobs. Not only can the QMS 3225 receive data from multiple active ports (including an optional network interface card), the printer can actually

process one job while it's printing another. A variety of paper feeders and a duplexer are available as options.

HONORABLE MENTION

Lexmark's \$2,899 IBM LaserPrinter 4039 12L and \$3,399 IBM LaserPrinter 4039 16L aren't the fastest printers we tested, but deserve honorable mention for their versatility, low price, and ergonomic design. These two units are the only reviewed network printers (other than the \$1,999 Lexmark LaserPrinter 12R) that offer an EPA Energy Star Computers-compliant power-saving mode. They also feature easy setup and an unusually clear control panel.

The \$3,895 Kyocera Ecosys a-Si Printer FS-3500A earns an honorable mention for containing per-page costs to a remarkable 0.8 cents. The Kyocera offers excellent performance, but its networking capabilities are less developed than its competitors'. PostScript emulation is not standard on the Kyocera, either. But if you want high performance with low consumables costs, the Kyocera is a real standout.

to accommodate different media, and the ability to adjust to several different forms lengths.

BASIC PERFORMANCE

No matter how many extras are engineered into a printer, speed and reliability are what most of us consider crucial. The QMS 3225 blazed past the others in the race to produce plain text pages using PCL, and when handling most of our PostScript graphics tests. The Printronix L3030 Duplex placed second on our Text Speed test, but fell to last place on our CorelDRAW test in PostScript mode.

Finally, speedy and reliable technical support is a must for a printer that will be shared by a whole department. Compaq leads the pack here, with 24-hour, seven-day-a-week telephone support. On-site service is particularly crucial in a network setup. Compaq, Genicom Corp., HP, Kyocera, Lexmark, and Output Technology each include one year of on-site service with the purchase price.

Printronix offers three months of on-site service and QMS offers on-site service as an option. Most other vendors offer normal Monday-through-Friday workday telephone support. Only Printronix does not offer any direct end-user support; that is left up to its distributors.

REVIEW CRITERIA

To be considered as a network laser printer, a printer had to use laser or LED technology, print at 12 ppm or better, and be shipping as of late July. In this section we review printers from Genicom, HP, Kyocera, Lexmark International, Output Technology Corp., Printronix, and QMS. For comparison, we also brought back the Compaq PageMarq 20, which was an Editors' Choice last year.

Two products, the Dataproducts LZR 1580 (\$3,450) and LZR 2080 (\$4,995), were not shipping in time for testing. We did not test eight other printers because manufacturers opted out or were not able to ship us products in time: the ATI LC

6832 (\$25,995), NCR 6490-1701 (\$4,375), NCR 6491-3012 Duplex (\$24,640), and NCR 6490-3011 Simplex (\$18,910), Olympus IS2030 Network Page Printer (\$6,295), Rosetta Technologies RT 3020 (price not available), Talaris 1794 FT Imagestation (\$7,490), and the Unisys AP9316 (\$3,399).

Each printer we tested was equipped with 16MB of RAM and all the options the vendor would provide. We tested text and graphics speed in a standalone setup, then connected each machine to a 10Base2 Ethernet network running NetWare to test ease of installation, emulation and port switching, font support, and remote-management capabilities.

Choosing the right printer is rarely a major factor when designing a LAN, but it can become the focus of attention once the network is up and running. Finding the right mix of throughput, connectivity, compatibility, and management utilities can pay off in user satisfaction and the administrator's peace of mind.

PENTIUM
TECHNOLOGY

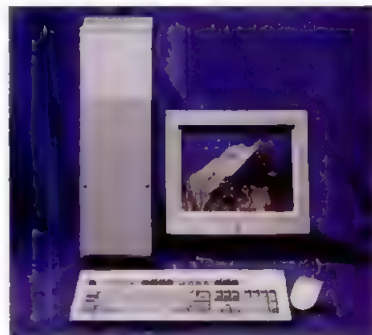
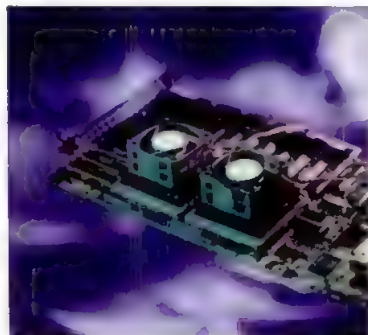
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Model DP60E/VL

- Intel Pentium processor, 60 MHz
- 64-bit processor complex
- 8MB RAM, max: 64MB
- 256KB processor cache
- 3.5" 1.44MB diskette drive
- 540MB SCSI hard disk
- Onboard dual-channel fast SCSI
- 8 32-bit EISA slots
- 2 local bus VESA slots
- ATI® Ultra Pro Mach 32, 2MB VRAM
- 15" Flat Square LR color monitor, NI
- Desktop casing (8 x 6; convertible to minitower)
- 200-watt autoswitching power supply
- MS-DOS® 6.0, Windows™ 3.1, mouse

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Model TP60E/VL¹

- Intel Pentium processor, 60 MHz; upgradeable to dual processors
- Dual 64-bit processor complex
- 16MB RAM, max: 128MB
- 512KB processor cache
- 3.5" 1.44MB diskette drive
- 540MB SCSI hard disk
- Onboard dual-channel fast SCSI
- 8 32-bit EISA slots
- 2 local bus VESA slots
- L25 S3 805 video accelerator, 1MB DRAM
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- 350-watt autoswitching power supply
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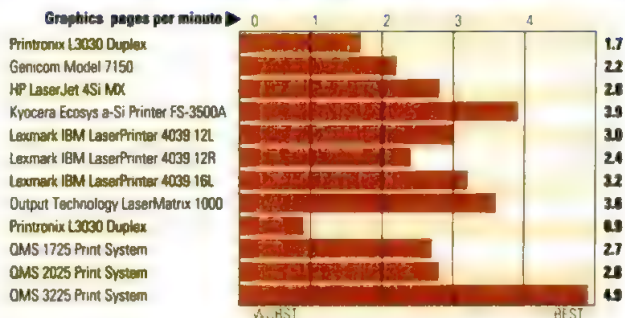
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Benchmark Tests: Network Lasers

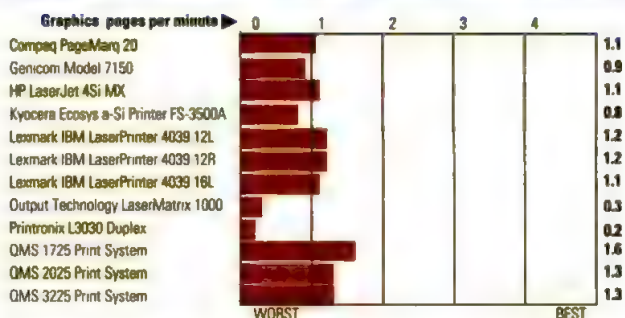
The 32-page-per-minute QMS 3225 Print System was the clear performance leader in both HP PCL and PostScript emulations. The 17-ppm QMS 2025 Print System was among the leaders in PostScript but proved only average under PCL. The 30-ppm Printronix L3030 Duplex was speedy when printing text but came in near the bottom when graphics were involved. Lexmark's three IBM LaserPrinters were the only network laser printers we tested that provided power-saver modes, and they were also the least power-hungry when idle.

Printing performance over a network is affected by the network's print queue management software and can vary depending on the network topology used. For these reasons, we chose to test printing speed by hooking the printers up directly to a PC via the parallel port. We performed each speed test in HP PCL mode and again in PostScript mode.

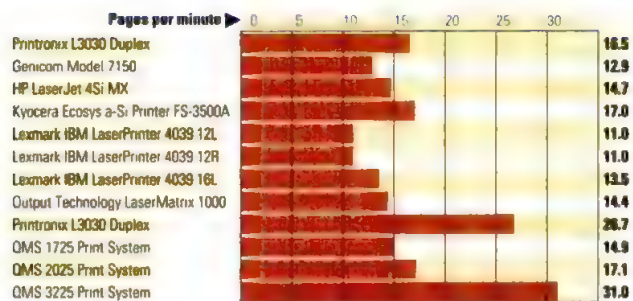
GRAPHICS SPEED (PCL)



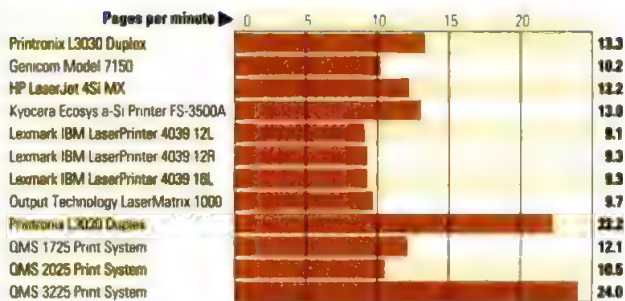
GRAPHICS SPEED (POSTSCRIPT)



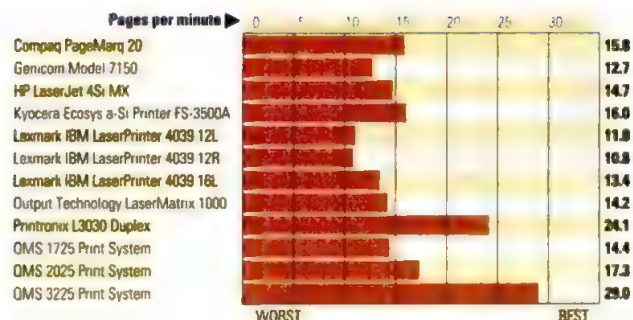
TEXT SPEED (PCL)



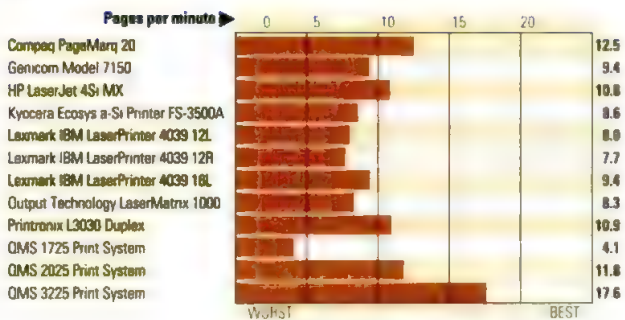
WORD FOR WINDOWS (PCL)



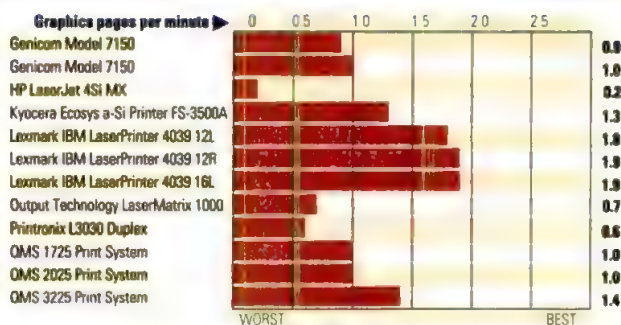
TEXT SPEED (POSTSCRIPT)



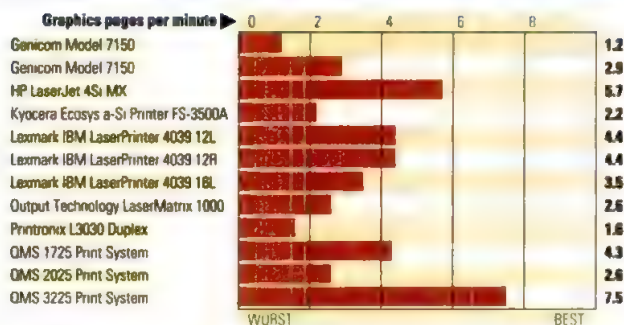
WORD FOR WINDOWS (POSTSCRIPT)



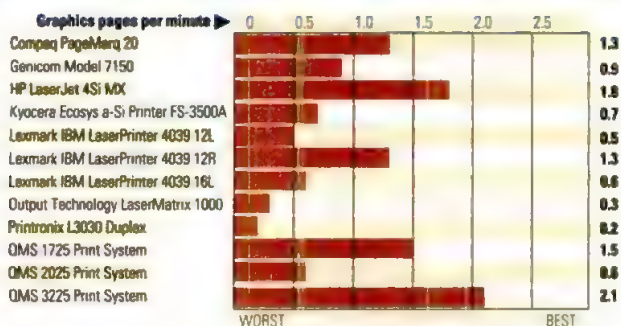
CORELDRAW (PCL)



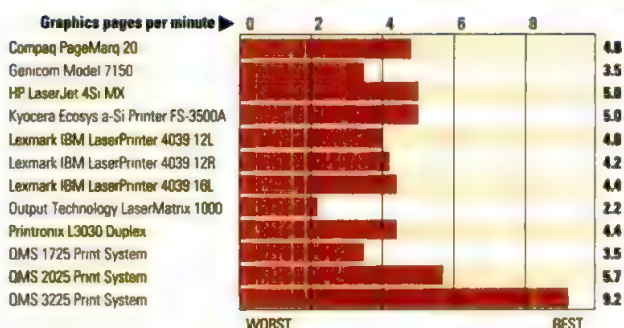
LOTUS 1-2-3 FOR WINDOWS (PCL)



CORELDRAW (POSTSCRIPT)



LOTUS 1-2-3 FOR WINDOWS (POSTSCRIPT)



The **Text Speed** test measures the printer's speed producing ten copies of a two-page business letter with 1-inch margins.

The **Graphics Speed** test measures the printer's speed in producing two copies of a complex single-page graphic containing a TIFF image, horizontal and vertical gray scales, and line art.

The **Word for Windows** test measures the printer's speed in producing a ten-page report that uses multiple fonts and type styles. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **CorelDRAW** test measures the printer's speed in producing a single-page CorelDRAW graphic that contains a TIFF image, horizontal and vertical gray scales, and line art. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **Lotus 1-2-3 for Windows** test measures the printer's speed in producing a complex two-page spreadsheet that contains pie, bar, and line charts. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **Power Consumption** test measures the printer's energy usage under three conditions: when printing, when idle, and when in power-saver mode (sleep mode), where available. For this test only, lower scores indicate better results.

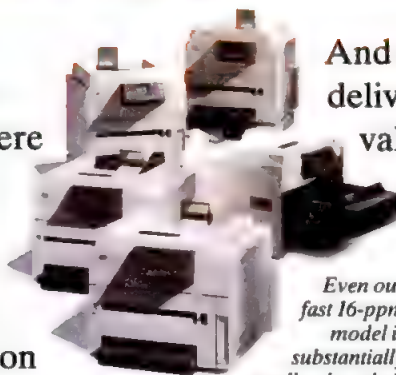
POWER CONSUMPTION

	Power consumption at rest (watts)	Power consumption when printing (watts)	Power consumption in power-saver mode (watts)
Compaq PageMarq 20	103	249	N/A
Genicom Model 7150	91	247	N/A
HP LaserJet 4Si MX	81	282	N/A
Kyocera Ecosys a-Si Printer FS-3500A	102	373	N/A
Lexmark IBM LaserPrinter 4039 12L	47	194	17
Lexmark IBM LaserPrinter 4039 12R	57	157	18
Lexmark IBM LaserPrinter 4039 16L	53	268	19
Output Technology LaserMatrix 1000 Model 6	86	289	N/A
Printronix L3030 Duplex	129	320	N/A
QMS 1725 Print System	105	299	N/A
QMS 2025 Print System	102	360	N/A
QMS 3225 Print System	163	689	N/A

N/A—Not applicable. This printer does not have a power-saver mode.

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Compaq Computer Corp.

Compaq PageMarq 20

BY JAMES KARNEY

The Compaq PageMarq 20 is aimed squarely at the network printer market, with a host of input options, a 20-page-per-minute engine, true Adobe PostScript Level 2 and HP PCL 5 emulations, easy-to-use controls, and a reasonable \$3,599 estimated street price (Compaq no longer publishes list prices). Since last year's special issue on printers, in which the PageMarq 20 received an Editors' Choice for shared lasers, Compaq has made some revisions to the network installation software, updated the ROM to print scanned images faster and with higher resolution, and added an enhanced printer cartridge that lasts 2,000 pages longer than the old one. Compaq also offers the Compaq PageMarq 15 (\$2,599), which offers most of the features of the PageMarq 20 but runs at 15 ppm.

The PageMarq 20 is based on a Fuji Xerox laser engine powered by an AMD Am29000 RISC 20-MHz processor with a 128K cache. The base configuration has 4MB (expandable to 20MB) of RAM, with HP PCL 5 (8 scalable and 7 bitmap fonts) and PostScript Level 2 (35 fonts) operation. An optional programmable font module lets you store up to 2MB of internal on-line fonts and clip art.

Maximum print resolution is 800-by-400—high enough for most graphics applications, and the PageMarq 20 makes use of Compaq's proprietary Print Enhancement technology with 300-dpi printing, smoothing jagged curves in text and graphics. Three motorized letter-size paper cassettes each store 500 sheets in two stacks of 250 sheets. When one 250-sheet stack runs out, the second stack moves automatically into place. You can also substitute an optional 250-sheet B-size cassette (\$89) for one of the letter-size trays.

The basic configuration includes serial and parallel ports. Compaq offers eleven NetLinq network interface cards with support for various combinations of cabling schemes, transport protocols, and network operating systems. The company also offers a PostScript fax card. The PageMarq 20 can switch among page description modes and can accept data simultaneously from all installed communications ports.

A network administrator utility bundled with each network interface card selects trays, specifies various configuration options, resets the printer, and checks status information from the PC. It can also run printer tests and download fonts.

Compaq Computer Corp., P.O. 692000, M120208

Houston, TX 77269-2000; 800-345-1518, 713-378-8820; fax, 713-378-1442.

EDITORS' CHOICE ▶ **Compaq PageMarq 20** Estimated selling price: \$3,599; 2MB RAM upgrade, \$164; 4MB RAM upgrade, \$246; 8MB RAM upgrade, \$452; 16MB RAM upgrade, \$822; internal 60MB hard disk, \$452; 1MB programmable font module, \$196; 2MB programmable font module, \$328; motorized 500-sheet letter-size paper cassette, \$89; 250-sheet paper cassettes (legal-, A4-, or executive-size), \$73 each; 500-sheet A4-size paper cassette, \$89; 250-sheet B-size paper cassette, \$89; 250-sheet 11-by-17 paper cassette, \$73; multi-purpose feeder (envelopes, labels, and transparencies) \$328; combination toner, drum, and developer cartridge, \$259. Connectivity options: internal fax modem, \$328; Compaq NetLinq for LAN Manager/LAN Server (10BaseT, thinnet, \$402; Token-Ring version, \$575); NetLinq for LAN Manager/LAN Server/Windows NT (10BaseT, thinnet, \$402; Token-Ring version, \$575); NetLinq for Netware (Token-



Ring), \$575; NetLinq for NetWare/EtherTalk (10BaseT or thinnet version), \$402; NetLinq for TCP/IP (10BaseT or thinnet version), \$452. Emulations: Adobe PostScript Level 2, HP PCL 5. Circle 503 on reader service card

Genicom Corp.

Genicom Model 7150

BY STEVEN C. M. CHEN

The Genicom Model 7150 is a no-frills 15-page-per-minute laser printer that offers tabloid-size printing at a reasonable price. We reviewed the three-bin version (two 250-sheet ledger and one 250-sheet letter), with a list price of \$3,979 and street price of \$2,900 to \$3,000. A two-bin version (ledger and letter) is also available for a list price of \$3,345 (street price, \$2,600 to \$2,700). Both versions of the 7150 lack resolution-enhancement features and automatic emulation switching. Only the parallel and serial ports can be operated concurrently. LocalTalk must be operated alone. However, the Genicom units do offer automatic selection between tabloid and standard paper trays. Both come standard with 4MB of RAM and can be expanded to 20MB via standard SIMMs.

The 7150 uses the Fuji Xerox XP-15 laser engine, which is rated at 15 ppm and is powered by a 25-MHz MIPS R3051 RISC processor. Resolution is 300 dpi in PCL 5 mode, which includes 13 scalable fonts, and 400 dpi in GeniScript, Genicom's own PostScript interpreter, which includes 35 fonts.

For a hookup to a NetWare network, we tested the GeniLink Model GL-740 (\$545), an external unit that attaches to the printer's parallel port and provides a connection for 10BaseT or 10Base2. It does not support emulation switching. Optional AS/400, IBM 3270, TCP/IP, and Token-Ring connections are also offered. The GL-740 also comes with its own remote management utility, PMAN,



Print Servers and Utilities

by Frank J. Derfler, Jr.

People want their printers within sight, earshot, and easy reach, but the old model of networked printing places the shared printers next to the file server, chained by relatively short parallel port connections. Today, a variety of devices allow you to place a shared printer anywhere within reach of the network cable. With a little planning, you can put printers where they are convenient and easily shared, and where they still allow people to hear the sound of their print jobs coming off the machine.

One solution is to buy a network laser printer like those we reviewed in this issue, which run at 12 pages per minute or better. Most of these units either come with or offer internal network adapters—so you can connect the printers anywhere on the network—and software appropriate for the network operating system. But what do you do if you want to connect the printer you already own to a network? You have two basic alternatives: Set up a PC as a remote print server or use an add-on print server device. Both of these alternatives have a couple of unique features.

Network operating systems such as Artisoft's LANtastic and Microsoft Windows for Workgroups allow you to use any PC as a print server. Under NetWare, third-party utilities such as Bitstream's Mosaic (\$695), Brightwork Development's PS-Print (\$395), Fresh Technology Co.'s Printer Assist (\$398), Intel Corp.'s LANSpool Software for NetWare (\$595), Software Directions' PrintQ LAN (\$495), and Third Planet Software's Network Assistant Plus VAP/NLM (\$435) run on a PC and receive print jobs from the file server. In some cases these products replace NetWare's own printing utilities and in other cases they work with them.

Using a PC as a print server offers

good economy, but it slows down and complicates other operations on the PC. The person using the PC print server is likely to see slower screen updates and disk drive actions when the PC is handling print jobs. Server software can conflict with other memory-intensive apps in the PC.

The alternative to using a PC as a print server is to buy dedicated hardware that gives the printer a network connection. This hardware comes as boards that fit into a printer's expansion slot or as small external devices that you connect to your printer's parallel port. Add-on print servers cost a little more than software solutions, but they avoid the hassle of loading a PC with print server software, they're easy to set up, and they offer better throughput.

There are some complexities, however. Under NetWare, an add-on print server offers better throughput and reliability when it acts as a remote node and not as a client to NetWare's RPrinter utility. But as a remote node, each shared printer counts as a network client, so adding a printer can force you to add users to your network operating system license. Other potential remote node problems include an inability to use encrypted passwords and to print special forms.

Some of the add-on print server devices, such as the Digital Products NETprint/100 (\$995) and the HP Jet-Direct EX (\$499 for Ethernet, \$699 for Token-Ring), can accept print jobs from servers that utilize different network communications protocols. The Apple Printer Access Protocol, NetWare IPX, and Unix IP are popular. Multiprotocol capabilities multiply the usefulness of a networked printer.

You can use an external print server device to share any printer, including the most humble dot matrix unit. Some single-printer devices from ASP Computer Products, Extended Systems, Hewlett-Packard (for HP printers only), Pacific Page, and Xircom attach

directly to the printer's parallel port. Other companies, such as Castelle, Intel, and Lexmark International, sell larger devices for attaching to multiple printers.

A few printers, particularly those from Hewlett-Packard, offer expansion slots that accommodate network interface cards (NICs). Companies such as ASP Computer Products, Castelle, and Hewlett-Packard market internal adapters designed for specific makes and models of printers. Adding an internal adapter to a printer essentially turns it into a network printer.

A major advantage of the internal products is their ability to receive jobs in different formats, such as Adobe PostScript or HP PCL, and the ability to set the printer for the appropriate format. If the printer can already do this job, then it probably does it better than the print server, but this is a valuable add-on feature for less-capable printers.

Developments waiting in the wings include devices that provide detailed management reports and products that conform to the new IEEE 1284 standard for the Hewlett-Packard and Microsoft Extended Capabilities Port (ECP). ECP-compatible devices move data in big blocks for optimal throughput and provide two-way communications for detailed management and reporting. Managed and IEEE 1284-compliant devices will ship over the next 12 months. □



which indicates when the paper tray is empty and when the printer is off-line.

The absence of any type of resolution-enhancement technology showed in the printer's graphics output, which, while acceptable, was not as sharp as that of the HP or Compaq and showed jagged edges.

The Genicom Model 7150 is worth considering for inexpensive tabloid-size printing, but its network-specific features are limited.

Genicom Corp., 14800 Conference Center Dr., #400, Chantilly, VA 22021; 800-443-6426; fax, 703-802-9039.

Genicom Model 7150 List price: two-bin, \$3,345; three-bin, \$3,979. 1MB RAM upgrade, \$170; 4MB RAM upgrade, \$470; 250-sheet paper cassettes (letter-, legal-, ledger-, or executive-size), \$76 each; multipurpose feeder (transparencies, envelopes, labels), \$470; fuser, \$225; toner cartridge, \$269. Connectivity options: IBM coax/twinax connection, \$725; NetWare Ethernet, \$575; NetWare Token-Ring, \$875; TCP/IP, \$875. Emulations: Adobe PostScript, HPGL, HP PCL 5. Circle 504 on reader service card.

Hewlett-Packard Co.

HP LaserJet 4Si

HP LaserJet 4Si MX

BY ALFRED POOR

There may be other printers that are faster than the 17-page-per-minute HP LaserJet 4Si and its PostScript-equipped stablemate, the HP LaserJet 4Si MX, but it may be difficult to find better candidates for shared use on a LAN.

The 4Si base model has 2MB of memory, HP PCL 5 support, a pair of 500-sheet paper cassettes, and a list price of \$3,749. The 4Si MX adds Adobe PostScript Level 2, which is an option for the 4Si, an additional 8MB of memory (10MB total), and Ethernet and LocalTalk interfaces for a list price of \$5,499. Street prices are about 80 percent of the suggested retail price, or about \$3,000 for the 4Si and \$4,399 for the 4Si MX.

An Intel RISC processor running at 25 MHz powers the controllers in these printers, producing results on our Text Speed tests (about 14.7 ppm at both 300- and 600-dpi) that were close to its rated

speed and fast graphics output. The high-speed bidirectional Bi-Tronics parallel interface also makes it possible to move data faster than over a traditional Centronics parallel port. Another print



speed-enhancing feature in Adobe PostScript mode is page buffering—the ability to format one page in a buffer while another is printing. Print quality, using the printer's 600-by-600 resolution and Resolution Enhancement Technology, is excellent, and both printers come with a large complement of scalable fonts.

There are many options available for both printers, including large-capacity input and output trays, duplex printing, and an envelope feeder, so you can buy only those features that you need.

Using the Ethernet card that comes standard with the 4Si MX, we were able to have the printer up and running on the network in just minutes; every aspect of the configuration could be handled from a workstation keyboard, and the default settings worked like a charm. After the printer is installed on the network, you can then use the HP JetPrint Windows utility, which provides .WAV file events to signal printer errors (so you can have your sound board announce when the printer is out of paper) and also lets you drag a file from File Manager and drop it onto the JetPrint icon to print a file. You can also use JetPrint to query the printer about its current status and download fonts. Another utility for the network administrator, JetAdmin, lets you modify the control panel from afar.

Both LaserJets feature simultaneously active I/O ports and flawless automatic emulation switching as well as the ability to switch automatically between ten different network operating systems.

Both save downloaded typefaces, macros, dictionaries, and other resources in memory when switching, so you don't end up with HP PCL versions of PostScript files or missing fonts.

Hewlett-Packard Company Co., Direct Marketing Organization, P.O. Box 5801, Steven's Creek Blvd., Santa Clara CA 95051-8059; 800-752-0900, 208-396-2551; fax, 800-333-1917.

HP LaserJet 4Si List price: \$3,749; 1MB SIMM, \$109; 2MB SIMM, \$189;

4MB SIMM, \$279; 8MB SIMM, \$539; Adobe PostScript Level 2 SIMM, \$799; 1,500-sheet letter-size paper cassette, \$649; 1,500-sheet A4-size paper cassette, \$685; extra paper trays (all sizes), \$129 each; 2,000-sheet output stacker, \$950; printer cabinet, \$420; duplexer, \$695; envelope feeder, \$495; combined toner/drum/developer cartridge, \$169. Connectivity options: HP JetDirect Ethernet/10BaseT interface card, \$449; HP JetDirect Ethernet/10BaseT/10Base2 interface card, \$499; HP JetDirect LocalTalk interface card, \$185; HP JetDirect Token-Ring interface card, \$699. Emulations: HP PCL 5.

EDITORS' CHOICE ▶ **HP LaserJet 4Si MX** List price: \$5,499. Options: same as for HP 4Si. Emulations: HP PCL 5, Adobe PostScript Level 2. Circle 505 on reader service card.

Kyocera Electronics Inc.

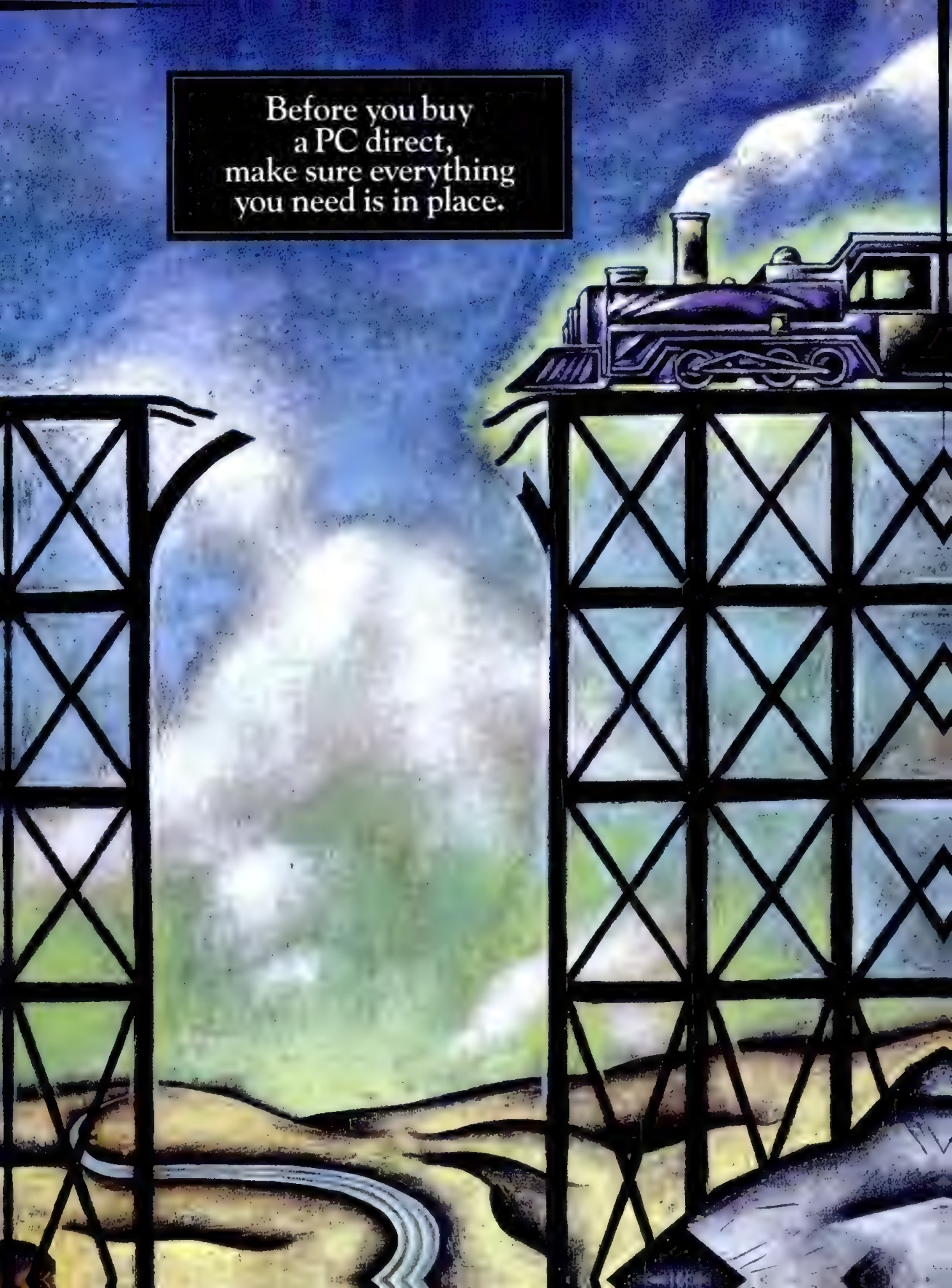
Kyocera Ecosys a-Si Printer FS-3500A

BY STEVE CHEN

Lower consumable costs, excellent paper-handling options, and ecologically correct features set the \$3,895 (street price, \$2,570) Kyocera Ecosys a-Si Printer FS-3500A apart from the crowd. Network-specific features are only average, however.

Like the 10-page-per-minute Kyocera Ecosys a-Si Printer FS-1500A—one of last year's Editors' Choice picks and a

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a PC direct,
make sure everything
you need is in place.



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Inmac Insignia 450SL

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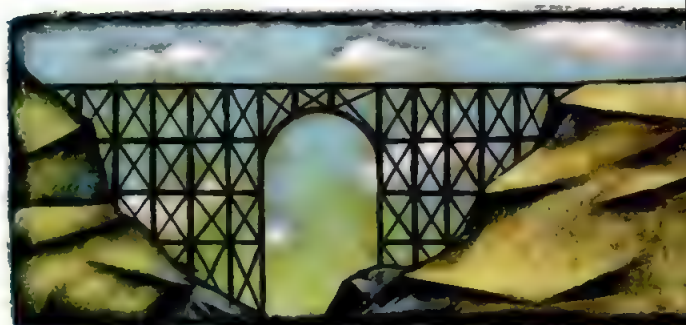
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INTRODUCING

486 PCs BUILT BY IBM. LOADED



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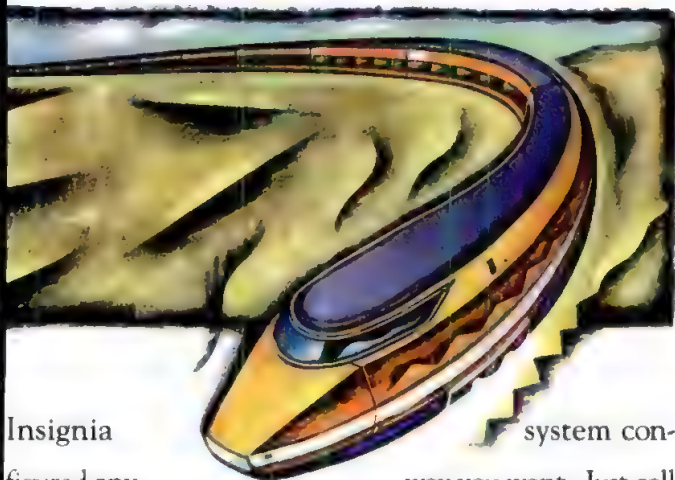
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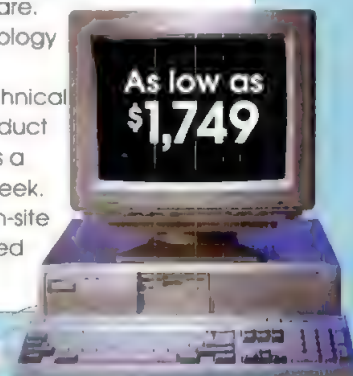
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- Paradox
- Quattro Pro
- Central Point PC Tools

\$2,599.
L1015PC

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- 2 ☐ Inmac Insignia 433P basic system with Intel 486 DX 33 MHz CPU; 8 KB write-thru cache.
- 3 ☐ Inmac Insignia 450P basic system with Intel 486 DX2 25/50 MHz CPU; 8 KB write-thru cache.
- 4 ☐ Inmac Insignia 466P basic system with Intel 486 DX2 33/66 MHz CPU; 8KB write-thru cache.

RAM

5 ☐ 4 MB 6 ☐ 8 MB 7 ☐ 16 MB 8 ☐ 32 MB 9 ☐ 64 MB
(N/A in 450SL)

MONITORS/VIDEO

- 10 ☐ SVGA Monitor 14", .28 1024 x 768 NI
- 11 ☐ SVGA/XGA Monitor 17", .28 1024 x 768 NI

HARD DRIVE (Must check one)

- 12 ☐ 120 MB
- 13 ☐ 170 MB
- 14 ☐ 255 MB
- 15 ☐ 340 MB
- 16 ☐ 540 MB*

FLOPPY DRIVE (Must check at least one dual or 3.5")

- 17 ☐ Dual Floppy Drive 3.5" & 5.25" (single drive bay)
- 18 ☐ 3.5" Floppy Drive
- 19 ☐ 5.25" Floppy Drive (as second drive)

ADAPTER

- 20 ☐ SCSI Adapter
- 21 ☐ ORCHID Farenheit 1280° Plus

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- 22 ☐ Microsoft Word for Windows
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- 26 ☐ Lotus 1-2-3 for Windows
- 27 ☐ Borland Quattro Pro for Windows
- 28 ☐ MS Money

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- 29 ☐ Borland Paradox for Windows

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PRINTERS Network Lasers



Compaq PageMarq 20

\$3,599 (estimated street price)

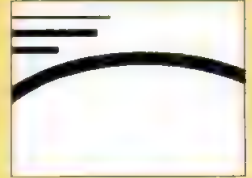
20-ppm B-size laser printer (Fuji Xerox engine) with 800- by 400-dpi output, Adobe PostScript Level 2, and HP PCL 5

PCL Text Speed: 16.5 ppm
PCL Graphics Speed: 1.7 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 13.3 ppm
CorelDRAW: 0.9 gppm
Lotus 1-2-3 for Windows: 1.2 gppm

PS Text Speed: 15.8 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 12.5 ppm
CorelDRAW: 1.3 gppm
Lotus 1-2-3 for Windows: 4.8 gppm



Courier Zapf Dingb
Helvetica Palatino
ITC Avant G Symbol
ITC Bookm: Times Roman



Genicom Model 7150

\$3,345

15-ppm B-size laser printer (Fuji Xerox XP-15 engine) with 400-dpi output, GeniScript PostScript interpreter, and HP PCL 5

PCL Text Speed: 12.9 ppm
PCL Graphics Speed: 2.2 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 10.2 ppm
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 2.9 gppm

PS Text Speed: 12.7 ppm
PS Graphics Speed: 0.9 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 9.4 ppm
CorelDRAW: 0.9 gppm
Lotus 1-2-3 for Windows: 3.5 gppm



Courier ITC Zapf Dir
Helvetica Palatino
ITC Avant G Symbol
ITC Bookm: Times Roman



HP LaserJet 4Si

\$3,749

17-ppm laser printer (Canon LBP-NX engine) with 600-dpi output, HP PCL 5; Adobe PostScript Level 2, \$799

PCL Text Speed: 14.7 ppm
PCL Graphics Speed: 2.8 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 12.2 ppm
CorelDRAW: 0.2 gppm
Lotus 1-2-3 for Windows: 5.7 gppm

PS Text Speed: 14.7 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 10.8 ppm
CorelDRAW: 1.8 gppm
Lotus 1-2-3 for Windows: 5.0 gppm



Albertus Ex CG Times
Antique Oli CG Times Ita
Antique Oli Courier
Arial Garamond F
Arial Italic Garamond K
CG Omega Letter Go



HP LaserJet 4Si MX

\$5,499

17-ppm laser printer (Canon LBP-NX engine) with 600-dpi output, Adobe PostScript Level 2, and HP PCL 5

PCL Text Speed: 14.7 ppm
PCL Graphics Speed: 2.8 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 12.2 ppm
CorelDRAW: 0.2 gppm
Lotus 1-2-3 for Windows: 5.7 gppm

PS Text Speed: 14.7 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 10.8 ppm
CorelDRAW: 1.8 gppm
Lotus 1-2-3 for Windows: 5.0 gppm



Courier ITC Zapf I
Helvetica Symbol
ITC Avant G Palatino Ron
ITC Bookm: Times Italic



Kyocera Ecosys a-Si Printer FS-3500A

\$3,895

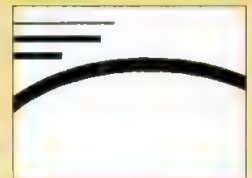
18-ppm LED printer (Kyocera engine) with 300-dpi output, HP PCL 5; Kyocera KPDL PostScript Interpreter, \$399

PCL Text Speed: 17.0 ppm
PCL Graphics Speed: 3.9 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 13.0 ppm
CorelDRAW: 1.3 gppm
Lotus 1-2-3 for Windows: 2.2 gppm

PS Text Speed: 16 ppm
PS Graphics Speed: 0.8 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 8.6 ppm
CorelDRAW: 0.7 gppm
Lotus 1-2-3 for Windows: 5.0 gppm



Courier Benguiat SWC
Dutch 801 Bodoni SWC Bo
Letter Goth Bookman SV
Line Printer Century Schoc
Prestige E1: Chianti SWC Ro
Swiss 721 Copper SWI



Announcing the first network printer



Operating System Topology

<i>Banyan Vines</i>	<i>*Ethernet/802.3</i>
<i>Novell Netware</i>	<i>*Ethernet/802.3</i>
	<i>Token Ring (4/16 Mbps)</i>
<i>Microsoft*</i>	<i>*802.3</i>
<i>LAN Manager</i>	<i>Token Ring (4/16 Mbps)</i>
<i>Windows for Workgroups</i>	<i>*802.3</i>
<i>Windows NT</i>	<i>Token Ring (4/16 Mbps)</i>
	<i>*802.3</i>
<i>IBM LAN Server</i>	<i>Token Ring (4/16 Mbps)</i>
	<i>*802.3</i>
<i>AppleTalk</i>	<i>Token Ring (4/16 Mbps)</i>
	<i>*LocalTalk</i>
	<i>*EtherTalk</i>
<i>HP-UX**</i>	<i>*Ethernet</i>
<i>SunOS**</i>	<i>*Ethernet</i>
<i>Solaris**</i>	<i>*Ethernet</i>
<i>SCO UNIX*</i>	<i>*Ethernet</i>

*Standard in the HP LaserJet 4Si MX printer. **For operating HP-UX, SunOS or Solaris, a one-time purchase of \$199 in configuration software is required. Adobe and PostScript are trademarks of Adobe Systems Inc. which may be registered in certain jurisdictions. Microsoft is a U.S. registered trademark of Microsoft Corporation. UNIX is a registered trademark of UNIX System Laboratories Inc. in the U.S.A. and other countries. †In Canada call 1 800-387-3867, Ext. 7299. © 1993 Hewlett-Packard PE12353

Multiple environments are no longer worlds apart. Even if you have Novell Netware on one network, HP-UX on another and EtherTalk on a third, the new HP LaserJet 4Si MX printer easily connects across platforms. Automatically.

The HP LaserJet 4Si MX printer comes out-of-the-box preconfigured for multiple environments. There's nothing more to do than plug-and-play. All interfaces are simultaneously hot, making switching so seamless, end-users won't even notice.

What's more, HP's LaserJet 4Si MX printer is ready to handle whatever needs come down the

that adapts to multiple environments.



pike. More operating systems? No problem. As your network system continues to evolve, the capabilities of this printer are no longer just impressive. They're indispensable.

The HP LaserJet 4Si MX printer is loaded with features that define state-of-the-art. HP's enhanced PCL5 and genuine PostScript™ Level 2 software from Adobe™ come standard. Printer environments are saved while switching. Setup is a cinch with network software utilities and drivers included in the box. And, if you need any reassurance about trouble-free operation, you have it in our Simple Network Management Protocol (SNMP) support.

At 17 ppm, this is the fastest LaserJet ever, with I/Os and RISC-based formatter capabilities matched to support its speed. It delivers impeccable 600 dpi print quality—thanks to HP's microfine toner and Resolution Enhancement technology. Plus, it comes standard with two 500 sheet input trays.

But what if you don't need the full capabilities of the HP LaserJet 4Si MX printer right away? HP offers another printer that's probably a perfect fit. The HP LaserJet 4Si printer delivers the identical 17 ppm performance and superb 600 dpi print quality. It also has room to grow. The two MIO expansion slots let you add

HP JetDirect network interface or third party cards. And you can add on Adobe's genuine PostScript Level 2 software and SIMM memory modules, as you need them.

To find out more about the multiple-network HP LaserJet 4Si MX printer and the upgradable HP LaserJet 4Si printer just call 1-800-LASERJET. Ext. 7299.† Capabilities this advanced make a world of difference—in any environment.



**HEWLETT
PACKARD**

PRINTERS
Network Lasers

Lexmark IBM LaserPrinter 4039 12L

\$2,899

12-ppm laser printer (Lexmark engine) with 600-dpi output, HP PCL 5, and Lexmark PostScript interpreter

PCL Text Speed: 11.0 ppm
PCL Graphics Speed: 1.0 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 11.0 ppm
CorelDRAW: 1.8 gppm
Lotus 1-2-3 for Windows: 4.4 gppm

PS Text Speed: 11.0 ppm
PS Graphics Speed: 1.0 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 11.0 ppm
CorelDRAW: 0.5 gppm
Lotus 1-2-3 for Windows: 4.0 gppm



AvantGard Helvetica
Bookman Palatino
Century Sc ΣυμβολΣετ
Courier Times New I



Lexmark IBM LaserPrinter 4039 12R

\$1,999

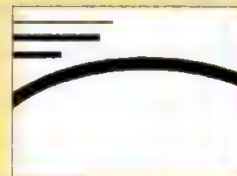
12-ppm laser printer (Lexmark engine) with 600-dpi output, HP PCL 5, and Lexmark PostScript interpreter

PCL Text Speed: 11.0 ppm
PCL Graphics Speed: 1.0 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 11.0 ppm
CorelDRAW: 1.9 gppm
Lotus 1-2-3 for Windows: 4.4 gppm

PS Text Speed: 10.8 ppm
PS Graphics Speed: 1.0 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 11.0 ppm
CorelDRAW: 1.3 gppm
Lotus 1-2-3 for Windows: 4.2 gppm



AvantGard Helvetica
Bookman Palatino
Century Sc ΣυμβολΣετ
Courier Times New I



Lexmark IBM LaserPrinter 4039 16L

\$3,399

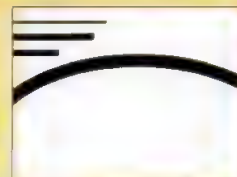
16-ppm laser printer (Lexmark engine) with 600-dpi output, HP PCL 5, and Lexmark PostScript interpreter

PCL Text Speed: 13.5 ppm
PCL Graphics Speed: 1.2 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 11.0 ppm
CorelDRAW: 1.9 gppm
Lotus 1-2-3 for Windows: 3.5 gppm

PS Text Speed: 11.4 ppm
PS Graphics Speed: 1.1 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 11.0 ppm
CorelDRAW: 0.6 gppm
Lotus 1-2-3 for Windows: 4.4 gppm



AvantGarc Helvetica
Bookman Palatino
Century Sc ΣυμβολΣετ
Courier Times New I



Output Technology LaserMatrix 1000 Model G

\$7,995

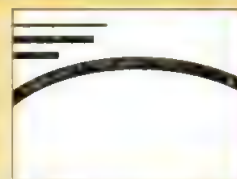
16-ppm continuous-form laser printer (Asahi Optical engine) with 300-dpi output, HP PCL 5, and Microsoft TrueImage PostScript Interpreter

PCL Text Speed: 14.4 ppm
PCL Graphics Speed: 3.6 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 9.7 ppm
CorelDRAW: 0.7 gppm
Lotus 1-2-3 for Windows: 2.6 gppm

PS Text Speed: 14.4 ppm
PS Graphics Speed: 0.3 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 9.7 ppm
CorelDRAW: 0.3 gppm
Lotus 1-2-3 for Windows: 2.2 gppm



Courier Symbol
Helvetica Palatino Ror
ITC Avant C Times Roma
ITC Bookm ☆*✱*⊠⊡
New Centu Συμβολ



Printronix L3030 Duplex

\$19,995

30-ppm LED printer (Kentek K30 engine) with 300-dpi output; HP PCL 5, \$595; PhoenixPage PostScript Level 2 interpreter, \$1,195

PCL Text Speed: 26.7 ppm
PCL Graphics Speed: 0.4 gppm
PCL WINDOWS APPLICATIONS:
Word for Windows: 22.2 ppm
CorelDRAW: 0.6 gppm

Lotus 1-2-3 for Windows: 1.6 gppm
PS Text Speed: 1.4 ppm
PS Graphics Speed: 0.2 gppm
PS WINDOWS APPLICATIONS:
Word for Windows: 11.9 ppm
CorelDRAW: 0.2 gppm
Lotus 1-2-3 for Windows: 4.4 gppm



Courier New Centu
Helvetica Symbol
ITC Avant C Palatino Ror
ITC Bookm Times Roma
ITC Zapf : ☆*✱*⊠⊡



PRINTERS
Network Lasers

QMS 1725 Print System

\$4,999

17-ppm laser printer (Canon NX engine) with 600-dpi output, HP PCL 4, and QMS PostScript Level 2 interpreter

PCL Text Speed: 14.9 gppm	PS Text Speed: 14.4 gppm
PCL Graphics Speed: 2.7 gppm	PS Graphics Speed: 1.6 gppm
PCL WINDOWS APPLICATIONS:	PS WINDOWS APPLICATIONS:
Word for Windows: 12.1 ppm	Word for Windows: 4.1 ppm
CorelDRAW: 1.0 gppm	CorelDRAW: 1.5 gppm
Lotus 1-2-3 for Windows: 4.3 gppm	Lotus 1-2-3 for Windows: 3.5 gppm



Courier ITC Bookm
Helvetica ITC Zapf Chan
Helvetica Coni New Century
Helvetica Narro Palatino
ITC Avant G Times



QMS 2025 Print System

\$12,995

20-ppm B-size laser printer (Ricoh M20 engine) with 400-dpi output, HP PCL 5, and QMS PostScript Level 2 interpreter

PCL Text Speed: 17.1 ppm	PS Text Speed: 17.3 ppm
PCL Graphics Speed: 2.8 gppm	PS Graphics Speed: 1.3 gppm
PCL WINDOWS APPLICATIONS:	PS WINDOWS APPLICATIONS:
Word for Windows: 10.5 ppm	Word for Windows: 11.8 ppm
CorelDRAW: 1.0 gppm	CorelDRAW: 0.6 gppm
Lotus 1-2-3 for Windows: 2.6 gppm	Lotus 1-2-3 for Windows: 5.7 gppm



Courier ITC Zapf Chan
Helvetica ☆*✱*✱
Helvetica Coni NewCentur
Helvetica Narro Palatino
ITC Bookm: Συμβολ Σερ
ITC Avant G Times



QMS 3225 Print System

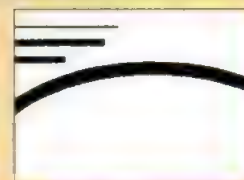
\$19,995

32-ppm B-size laser printer (Ricoh M32 engine) laser printer with 400-dpi output, HP PCL 5, and QMS PostScript Level 2 interpreter

PCL Text Speed: 31.0 ppm	PS Text Speed: 29.0 ppm
PCL Graphics Speed: 4.9 gppm	PS Graphics Speed: 1.3 gppm
PCL WINDOWS APPLICATIONS:	PS WINDOWS APPLICATIONS:
Word for Windows: 24 ppm	Word for Windows: 17.6 ppm
CorelDRAW: 1.4 gppm	CorelDRAW: 2.1 gppm
Lotus 1-2-3 for Windows: 7.5 gppm	Lotus 1-2-3 for Windows: 9.2 gppm



Courier ITC Zapf Chan
Helvetica ☆*✱*✱
Helvetica Coni NewCentur
Helvetica Narro Palatino
ITC Bookm: Συμβολ Σερ
ITC Avant G Times



1992 Technical Excellence award winner—the 18-ppm FS-3500A features a drum and photoconductor that last the life of the printer. The only real consumable that needs periodic replacing is the toner, which contains microfine ceramic particles that continually clean, polish, and recondition the drum. A \$49 toner cartridge is good for 6,000 pages, resulting in a per-page cost (0.8 cents) that is one of the lowest of any laser printer reviewed here.

Powered by a 16-MHz AMD Am29000 RISC processor, the FS-3500A is based on Kyocera's own LED array engine, which is rated at 18-ppm with 300-dpi resolution. It offers HP PCL 5 emulation and includes 87 bitmapped and 59 scalable fonts.

The basic unit includes only one 250-sheet letter-size paper tray. Options include one or two 500-sheet multipurpose paper trays, a duplexer, and a 15-



bin sorter/stacker. The basic unit does not support automatic emulation switching, but it does allow simultaneously active parallel and serial ports.

The optional IB-4X NetWare Ethernet network interface card was included with our test unit. Setting up the card is a straightforward process. Our only criticism is that the NIC forces you to allow unencrypted passwords on your file server. Unlike the basic FS-3500A, the

IB-4X supports automatic emulation switching between HP PCL and KPDL, Kyocera's own PostScript interpreter, which is available as a \$399 option and includes 47 fonts.

Remote management features are limited: Using a combination of an included utility and PCONSOLE, you can run a test print, find out if the printer is off-line or out of paper, detect if there is a paper jam or if the cover is open, and display an error log—but you cannot modify the control panel.

The FS-3500A's print quality was good for a 300-dpi printer, with many potential jagged edges eliminated by the Kyocera Image Refinement (KIR) technology. Speed was also respectable. The FS-3500A printed text at 17 ppm in HP PCL and 16 ppm in PostScript. Graphics printed at 3.9 graphics-pages-per-minute in HP PCL and a less impressive 0.8 gppm in PostScript.

Imagine a notebook that adjusts to the way you work instead of the other way around. The keyboard detaches when that's more convenient. You can use the pen as a pointing device, to highlight or delete text, or to take notes (you know, like a pen). And unlike "convertible" notebooks, you can comfortably use both the keyboard and pen at the same time



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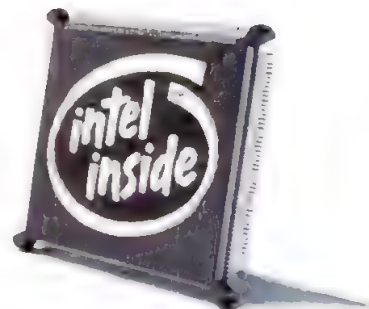


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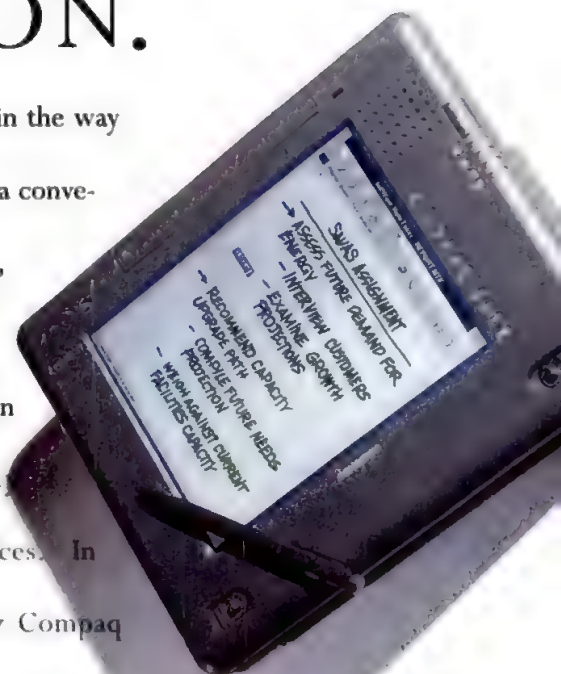
allows you to add a variety of

industry-standard devices. In

other words, the new Compaq

Concerto works in an incredible number of ways.

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COMPAQ

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CIRCLE 308 ON READER SERVICE CARD

PRINTERS

Network Lasers

Kyocera Electronics Inc., 100 Randolph Rd., Somerset, NJ 08875; 800-367-7437, 908-560-3400; fax, 908-560-8380.

Kyocera Ecosys a-Si Printer FS-3500A List price: \$3,895; 1MB RAM upgrade, \$79; 4MB RAM upgrade, \$269; KPDL interpreter, \$399; 250-sheet paper cassettes (letter-, legal-, A4-, or executive-size), \$49 each; 500-sheet multipurpose feeder, \$399; 70-envelope cassette, \$199; duplexer, \$699; 15-bin sorter, \$1,995; fuser, \$285; drum, \$492; toner, \$49; developer, \$240. Connectivity options: LocalTalk, \$199; NetWare Ethernet, \$499; NetWare Token-Ring, \$499. Emulations: Diablo 630, Epson LQ, HPGL, HP PCL 5, IBM Proprinter, line printer. Circle 506 on reader service card



The IBM LaserPrinter 4039 16L, 12R, and 12L

font, and 14 bitmap fonts, and one slot to support optional font cartridges.

An optional Ethernet or Token-Ring network interface card provides compatibility with AIX, Microsoft LAN Manager, NetWare, and OS/2 LAN Server, with automatic NOS switching on combined networks. It also comes with flash memory, so a network administrator can remotely change or add network protocols. LocalTalk cards are also available. The network interface cards also support bidirectional communications and come with a utility that lets the administrator download fonts, change the control panel, reset the printer, and set various defaults from a workstation. The utility also alerts the administrator when paper jams and the printer runs out of toner or paper.

The LaserPrinter 12R, which sells for around \$1,679, has a 200-sheet capacity and can accommodate a 130-page duplexing feeder, a 75-envelope feeder, or an additional 500-sheet paper cassette. The LaserPrinter 12L, around \$2,379, also uses the AMD 29000 controller but offers a 500-sheet base capacity, expandable to 1,100 sheets. The LaserPrinter 16L, which typically sells for around \$2,839, shares the LaserPrinter 12L's form factor but uses a 20-MHz AMD Am29000 chip instead of a 16-MHz chip.

The LaserPrinters' output quality isn't superb: Under PCL emulation, they print at only 300- by 300-dpi and reproduce gray scales poorly. But the price is right, and for moderate-duty network printing these three units will perform ably.

Lexmark International Inc., 740 New Circle Rd., Lexington, KY 40511; 800-358-5835; fax, 606-232-2380.

IBM LaserPrinter 12L List price:

\$2,899; 2MB RAM upgrade, \$199; 4MB RAM upgrade, \$299; 8MB RAM upgrade, \$499; MarkFlash memory: 1MB, \$289; 2MB, \$469; font cartridges, \$239 each; font cartridge external adapter, \$79; 500-sheet letter-size paper cassette, \$129; second 500-sheet letter-size paper cas-

sette, \$349; 500-sheet legal-size paper cassette, \$139; second 500-sheet legal-size paper cassette, \$359; 100-sheet auxiliary paper cassette, \$229; 75-envelope feeder, \$349; 300-sheet duplexing feeder, \$699; extra 300-sheet duplex cassette, \$149; combined toner/drum/developer cartridge, \$199 for 10,000-page life, \$269 for 20,000-page life. Connectivity options: LocalTalk, \$299; 10BaseT, \$439; 10Base2, \$489; Token-Ring, \$649. Emulations: Adobe PostScript, HP PCL 5.

IBM LaserPrinter 12R List price: \$1,999; 130-sheet duplexing feeder, \$699; extra 130-sheet duplex paper cassette, \$159. Other prices and options: same as for LaserPrinter 12L. Emulations: Adobe PostScript, HP PCL 5.

IBM LaserPrinter 16L List price: \$3,399. Font cartridge external adapter, \$209. Other prices and options: same as for LaserPrinter 12R. Emulations: Adobe PostScript, HP PCL 5.

Circle 507 on reader service card

Lexmark International Inc.

IBM LaserPrinter 4039 12L

IBM LaserPrinter 4039 12R

IBM LaserPrinter 4039 16L

BY ANGELA GUNN

Lexmark International, formerly a division of IBM, markets the IBM LaserPrinter 12R, IBM LaserPrinter 12L, and IBM LaserPrinter 16L as a high-performance desktop printer, a high-volume network printer, and a high-performance network printer, respectively.

For list prices ranging from \$1,999 to \$3,399 (street prices \$1,679 to \$2,839), all three models offer 12- to 16-page-per-minute performance, strong paper-handling features, and 600- by 600-dpi resolution under Lexmark's PostScript emulation. The Lexmark printers are also the only network lasers we tested that offer a power-saving mode, which cuts their power usage to under 20 watts when idle for 4 minutes (for the 12L and 16L) or 90 seconds (for the 12R).

All three units are built around the same Lexmark engine and AMD 29000-family RISC controllers. All come with 4MB RAM, expandable to 16MB, and offer automatic emulation switching and simultaneously active parallel, serial, and optional network interfaces. Optional flash memory lets you store forms, macros, fonts, and logos. Standard font support includes 39 Adobe Type 1, 13 Intelli-

Output Technology Corp.

Output Technology LaserMatrix 1000 Model 6

BY JOSEPH DESPOSITO

Output Technology Corp. successfully blends a laser printer with a tractor-feed mechanism in the 16-page-per-minute LaserMatrix 1000 Model 6, list priced at \$7,995 (street price, \$6,995). In Adobe PostScript and HP PCL 5 emulations, the Output Technology LaserMatrix 1000 Model 6 generates unenhanced 300-dpi output, but that's not a critical limitation in a unit designed for high-volume text, forms, and label printing.

June 14, 1963.
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Introducing the QMS ColorScript Laser 1000. Now your business has total freedom of expression.

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PRINTERS
Network Lasers

► **S U M M A R Y O F F E A T U R E S**

CONTINUES

Network Lasers

Products listed in alphabetical order

■ = YES □ = NO



	Compaq PageMarq 20	Genicom Model 7150	HP LaserJet 4Si	HP LaserJet 4Si MX	Kyocera Ecosys a-Si Printer FS-3500A	Lexmark IBM LaserPrinter 4039 12L	Lexmark IBM LaserPrinter 4039 12R
List price	\$3,599 (estimated street price)	\$3,345	\$3,749	\$5,499	\$3,895	\$2,899	\$1,999

Physical Characteristics

Dimensions (HWD, in inches)	19.4 x 20.4 x 17.1	16 x 16 x 20	16.5 x 21.7 x 29.9	16.5 x 21.7 x 29.9	10.2 x 13.6 x 13.8	11.8 x 14.9 x 21.1	16.1 x 14.9 x 21.1
Weight (pounds)	83	72	94	94	35	46	40
Engine type	Laser	Laser	Laser	Laser	LED array	Laser	Laser
Engine model	Fuji Xerox	Fuji Xerox XP-15	Canon LBP-NX	Canon LBP-NX	Kyocera	Lexmark	Lexmark
Maximum resolution in HP PCL (dpi)	300 x 300	300 x 300	600 x 600	600 x 600	300 x 300	300 x 300	300 x 300
Maximum resolution in PostScript (dpi)	800 x 400	400 x 400	N/A †	600 x 600	300 x 300	600 x 600	600 x 600
RISC processor	20-MHz AMD Am29000	25-MHz MIPS R3051	25-MHz Intel 80960CF	25-MHz Intel 80960CF	16-MHz AMD Am29000	16-MHz AMD Am29000	16-MHz AMD Am29000
Rated engine speed (pages per minute)	20	15	17	17	18	12	12
Single-cartridge toner/developer/drum	■	■	■	■	□	■	■
Toner capacity (images)	14,000	12,000	8,000	8,000	6,000	10,000	10,000
Standard, maximum RAM	4MB, 20MB	4MB, 20MB	2MB, 34MB	10MB, 26MB	2MB, 18MB	4MB, 16MB	4MB, 16MB
Accepts standard SIMMs	■	■	■	■	■	■	■

Interfaces

Parallel/serial port	■ ■	■ ■	■ □	■ □	■ ■	■ ■	■ ■
LocalTalk port	Optional	■	Optional	■	Optional	Optional	Optional
SCSI port for hard disk	□	□	□	□	□	□	□
Ethernet	Optional	Optional	Optional	■	Optional	Optional	Optional
Token-Ring	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Automatic interface switching	■	■	■	■	■	■	■
Simultaneously active ports	■	□	■	■	■	■	■
Number of expansion slots	4	4	4	4	4	1	1

Paper Handling

Paper support	Cut-sheet	Cut-sheet	Cut-sheet	Cut-sheet	Cut-sheet	Cut-sheet	Cut-sheet
Capacity of each standard input cassette (sheets)	500, 500, 500	250	500, 500	500, 500	250	500	200
Capacity of each standard output tray (sheets)	500 (facedown), 250 (faceup)	250 (facedown), 250 (faceup)	500	500	250 (facedown), 250 (faceup)	500	250
Can print on B-size paper	■	■	□	□	□	□	□
Duplexing	□	□	Optional	Optional	Optional	Optional	Optional
Rated maximum paper weight (pounds)	32	24	28	28	24	35	35
Rated duty cycle (pages per month)	50,000	30,000	75,000	75,000	50,000	50,000	35,000

Fonts and Features

HP PCL support	PCL 5	PCL 5	PCL 5	PCL 5	PCL 5	PCL 5	PCL 5
PostScript language support	Adobe PostScript Level 2	Geniscript	Optional (Adobe PostScript Level 2)	Adobe PostScript Level 2	Optional (Kyocera KPD) [KPD]	Lexmark	Lexmark
Number of Type 1 fonts provided	35	35	N/A ‡	35	N/A ‡	39	39
Automatic emulation switching	■	□	■	■	Optional	■	■
Resolution enhancement	■	□	■	■	■	■	■
Printer-specific Windows 3.1 driver available	■ (included)	■ (included)	■ (included)	■ (included)	■ (in Windows)	■ (in Windows)	■ (in Windows)

Customer Support

Toll-free technical support	■	□	■	■	■	□	□
Telephone support hours (eastern time)	24 hours	8:00–7:00 M–F	9:00–8:00 M, T, Th, F; 9:00–6:00 W	9:00–8:00 M, T, Th, F; 9:00–6:00 W	9:00–9:00 M–F	10:00–7:00 M–F	10:00–7:00 M–F
BBS	■	■	□	□	■	■	■
Warranty	1 year	1 year on-site	1 year	1 year	1 year; 3 years on LED and drum	1 year	1 year

N/A †—Not applicable. The product does not have this feature.

N/A ‡—Not applicable. This unit is not a PostScript printer.

PRINTERS
Network Lasers

SUMMARY OF FEATURES

ENDS

Products listed in alphabetical order

■ = YES □ = NO



	Lexmark IBM LaserPrinter 4039 16L	Output Technology LaserMatrix 1000 Model 6	Printronix L3030 Duplex	QMS 1725 Print System	QMS 2025 Print System	QMS 3225 Print System
List price	\$3,399	\$7,995	\$19,995	\$4,999	\$12,995	\$19,995
Physical Characteristics						
Dimensions (HWD, in inches)	16.2 x 14.9 x 21.1	7.5 x 18.1 x 18	15 x 25 x 20	19 x 21.6 x 22.4	29.5 x 37.4 x 25.8	29.5 x 37.4 x 25.8
Weight (pounds)	46	43	136	106	187	187
Engine type	Laser	Laser	LED array	Laser	Laser	Laser
Engine model	Lexmark	Asahi Optical	Kentek K30	Canon NX	Ricoh M20	Ricoh M32
Maximum resolution in HP PCL (dpi)	300 x 300	300 x 300	300 x 300	600 x 600	400 x 400	400 x 400
Maximum resolution in PostScript (dpi)	600 x 600	300 x 300	300 x 300	600 x 600	400 x 400	400 x 400
RISC processor	20-MHz AMD Am29000	20-MHz Intel 80960KB	N/A †	25-MHz Intel 80960CF	33-MHz IDT 3081E	33-MHz IDT 3081E
Rated engine speed (pages per minute)	16	16	30	17	20	32
Single-cartridge toner/developer/drum	■	□	□	■	□	□
Toner capacity (images)	12,000	8,000	34,000	8,000	20,000	30,000
Standard, maximum RAM	4MB, 16MB	2MB, 12MB	8MB, 24MB	8MB, 32MB	16MB, 32MB	16MB, 32MB
Accepts standard SIMMs	■	■	□	■	■	■
Interfaces						
Parallel/serial port	■ ■	■ ■	■ ■	■ ■	■ ■	■ ■
LocalTalk port	Optional	Optional	□	■	■	■
SCSI port for hard disk	□	□	□	Optional	■	■
Ethernet	Optional	Optional	□	Optional	Optional	Optional
Token-Ring	Optional	Optional	□	Optional	Optional	Optional
Automatic interface switching	■	■	■	■	■	■
Simultaneously active ports	■	□	□	■	■	■
Number of expansion slots	1	1	□	3	2	2
Paper Handling						
Paper support	Cut-sheet	Continuous-form	Cut-sheet	Cut-sheet	Cut-sheet	Cut-sheet
Capacity of each standard input cassette (sheets)	500	N/A †	550, 250	500, 500, 100	250	250
Capacity of each standard output tray (sheets)	500	N/A †	550	500 (faceup), 100 (facedown)	1,500 (facedown), 100 (faceup)	1,500 (facedown), 100 (faceup)
Can print on B-size paper	□	□	□	□	■	■
Duplexing	Optional	□	■	Optional	Optional	Optional
Rated maximum paper weight (pounds)	35	40	24	36	24	24
Rated duty cycle (pages per month)	75,000	25,000	150,000	75,000	100,000	200,000
Fonts and Features						
HP PCL support	PCL 5	PCL 5	Optional (PCL 5)	PCL 4	PCL 5	PCL 5
PostScript language support	Lexmark	Microsoft TrueImage	Optional (PhoenixPage Level 2)	QMS Level 2	QMS Level 2	QMS Level 2
Number of Type 1 fonts provided	39	35	N/A ‡	39	39	39
Automatic emulation switching	■	■	□	■	■	■
Resolution enhancement	■	□	□	□	□	□
Printer-specific Windows 3.1 driver available	■ (in Windows)	■ (via BBS or by request)	□	■ (included)	■ (included)	■ (included)
Customer Support						
Toll-free technical support	□	□	□	□	□	□
Telephone support hours (eastern time)	10:00–7:00 M–F	9:00–7:00 M–F	N/A †	8:00–5:00 M–F	8:00–5:00 M–F	8:00–5:00 M–F
BBS	■	■	□	■	■	■
Warranty	1 year	1 year	3 months	2 years	3 months	3 months

N/A †—Not applicable. The product does not have this feature

N/A ‡—Not applicable. This unit is not a PostScript printer

PRINTERS

Network Lasers

The LaserMatrix can digest 2,000 sheets of fanfold paper at a time. The tractor-feed mechanism resides inside the printer; you lift the top half of the printer and lay the paper inside.



The Output Technology LaserMatrix 1000 Model 8

The LaserMatrix's forms printing features include vertical image registration to $\frac{1}{150}$ inch and user control of the fuser temperature to accommodate a wide variety of forms and labels. The LaserMatrix also features a forms and labels saver that can adjust page sizes for forms of different lengths.

The LaserMatrix is powered by an Intel i960 RISC processor and an Asahi

Optical print engine. There are separate components for the toner and drum.

The unit's performance approached its 16-ppm rating on our Text Speed test. It was one of the fastest printers we tested when handling Windows graphics under the HP PCL emulation; it was one of the slowest under PostScript.

The printer automatically switches among emulations as well as between serial and parallel ports. Output Technology does offer internal Ethernet and Token-Ring adapters for running under NetWare and TCP/IP, but did not provide any adapters for testing.

The LaserMatrix's PostScript emulation includes 35 standard fonts; its HP PCL emulation includes eight internal scalable typefaces and seven internal bit-mapped fonts. Another member of the LaserMatrix family, the Model 5, offers the same set of features except for PostScript emulation, and sells for \$7,395.

Output Technology Corp., 2310 N. Fancher Rd., Spokane, WA 99212-1381; 509-536-0468; fax, 509-533-1280.

Output Technology LaserMatrix 1000

Model 6 List price: \$7,995; paper stacking tray, \$231; label stacking tray, \$195; drum cartridge, \$311; toner cartridge kit (two cartridges), \$143; developer kit, \$338. Connectivity options: coax network adapter, \$1,295; twinax network adapter, \$1,295; Ethernet network adapter (NetWare or TCP/IP), \$795, LocalTalk interface, \$495; Token-Ring network adapter (NetWare or TCP/IP), \$795. Emulations: Adobe PostScript, HP PCL 5. Circle 508 on reader service card

Printronix Inc.

Printronix L3030 Duplex

BY BILL DYSZEL

One of two 30-page-per-minute printers in our roundup, the \$19,995 (street price, about \$16,000) Printronix L3030 Duplex LED printer is best suited for high-volume, text-only output. The only emulation that comes standard is Printronix LinePrinter Plus. Adobe PostScript (35 fonts) and HP PCL 5 (7 bitmap fonts, 8 scalable) emulations are options at

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AVERY

Network Lasers

\$1,195 and \$595 respectively. A version of the L3030 without duplexing is also available for a list price of \$14,995 (street price, about \$13,000). That version cannot be upgraded to duplex.

The L3030 Duplex is built around a Kentek 300-dpi LED engine that does not offer resolution enhancement. Text speed, without the duplexing feature enabled, is a fast 26.7 ppm in PCL mode and 24.1 ppm in PostScript. Even when duplexing the unit prints text at 24 ppm. Graphics speed is sluggish, however, and graphics output quality is below average: The L3030 Duplex had trouble reproduc-

ing gray levels in HP PCL 5 and showed noticeable banding when printing PostScript graphics.

paper cassettes and stackers are available for \$1,295 each. The Printronix L3030's monthly duty cycle of 150,000 pages is higher than that of any of the other printers in this section except the QMS 3225 Print Systems'.

Printronix Inc., 17500 Cartwright Rd., Irvine, CA, 92713; 800-826-3874, 714-863-1900; fax, 714-660-8682.

Printronix L3030 Duplex List price:

\$19,995; 4MB RAM upgrade, \$495; PhoenixPage PCL 5 emulation, \$595; PhoenixPage PostScript emulation, \$1,195; motorized 1,400-sheet paper cassette, \$1,295; 1,400-sheet output stacker, \$1,295; toner cartridge kit (package of two), \$98; photoconductor unit, \$351; developer unit, \$995. Emulations: Printronix LinePrinter Plus.

Circle 509 on reader service card.



ing gray levels in HP PCL 5 and showed noticeable banding when printing PostScript graphics.

Network-specific features are also lacking: There is no slot for an internal network interface card, and Printronix offers no network interface options. To

One of two 30-page-per-minute printers in our roundup, the Printronix L3030 Duplex LED is best suited for high-volume, text-only output.

switch emulations you must turn off the printer and reboot it from two floppy disks—a clumsy method compared with the automatic emulation switching offered by most other network printers in this section.

The standard paper cassettes hold up to 800 sheets of paper in any size from letter to legal. Motorized 1,400-sheet

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QMS Inc.

QMS 1725 Print System**QMS 2025 Print System****QMS 3225 Print System**

BY STEPHEN W. PLAIN

Three printers from QMS offer a combination of features ideally suited for LAN use. All three come with HP PCL and Adobe PostScript emulations with automatic emulation switching, plus simultaneous port access with precise control over memory allocation. The 17-page-per-minute, 600-dpi QMS 1725 Print System is a direct competitor for the HP 4Si MX, and is list priced at \$4,999 with a street price of \$4,499. The 20-ppm QMS 2025 Print System (\$12,995 list, \$11,399 street) and 32-ppm QMS 3225 Print System (\$19,995 list, \$17,499 street) are 400-dpi replacements for QMS's 2000 and 3000 models.

QMS's new printers all employ the

company's Crown technology, which uses the printers' RISC processors to provide true multitasking of multiple print jobs. All of the installed interfaces, including serial, parallel, and AppleTalk, can accept input at once. Each incoming job is spooled to memory or to the printer's hard disk, then passed through the appropriate language interpreter and converted into a standard format. The Crown architecture also lets you use the printer's LCD control panel to customize input spool buffers, font cache RAM, and other memory allocations between interfaces to process jobs more efficiently.

These printers offer straightforward network setup, though physical installation of the optional network interface on the QMS 1725 proved challenging. All three units can be configured to act as a

NetWare PSERVER through the control panel, and, when power comes up, they automatically register themselves to the network. Network interface cards are available for Ethernet connections running under EtherTalk, NetWare, TCP/IP, or concurrent DECnet and TCP/IP.

Token-Ring NICs are also available for NetWare and TCP/IP. The TCP/IP-compatible NICs have a remote management utility that alerts users when paper jams or when the printer is out of paper or toner, and lets administrators modify the control panel from a PC.

The NetWare-compatible network interface cards lack these remote management features.

The QMS 1725 is based on a 25-MHz Intel i80960CF RISC processor. While it is very competitive with the HP LaserJet 4Si MX, the Ethernet NetWare interface

*QMS's new printers
employ the company's
Crown technology,
which uses the printer's
RISC processors, to
multitask print jobs.*

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Speed



Price

PRINTERS
Network Lasers

card is not included in the basic system as it is with the HP, but sells for \$895. This option was surprisingly difficult to install, requiring the removal of a large interface tray from the bottom of the unit. The QMS 1725 offers Adobe PostScript Level 2 (39 fonts) and HP PCL 4 emulations.

The QMS 2025 and QMS 3225 are floor-standing monsters meant for heavy-duty batch printing and B-size output. Except for performance and price, the two are identical: Both offer optional 1,000-page paper cassettes in addition to the two standard 250-page cassettes. Dual 750-page standard output trays have sensors to detect when they're full.

Each of these printers comes with an internal 40MB SCSI hard disk and a 3.5-inch floppy disk drive, which offers a dual purpose. In addition to job spooling, the hard disk also contains the printer's system software; thus, you can use the floppy



disk drive to install upgrades instead of pulling a ROM chip as in previous models.

The QMS 2025 and QMS 3225 come with HP PCL 5 (14 bitmap fonts) and Adobe PostScript Level 2 (39 fonts) emulations. □

QMS Inc., One Magnum Pass, Mobile, AL 36618; 800-523-2636, 205-633-4300; fax, 205-633-4866.

QMS 1725 Print System List price: \$4,999; 4MB SIMM, \$459; 8MB SIMM, \$799; 120MB internal SCSI hard disk,

\$1,195; HPGL 7475/7550 emulations, \$295 each; LN03+ emulation, \$49; pro collection font cartridge, \$295; 500-sheet paper cassettes (letter-, legal-, executive-, or A4-size), \$129 each; 1,500-sheet letter-size paper cassette, \$695; 100-envelope feeder, \$495; Ethernet EtherTalk card, \$895; Ethernet TCP/IP card, \$1,395; Ethernet NetWare card, \$895; Token-Ring NetWare card, \$1,095; Token-Ring TCP/IP card, \$1,170. Emulations: HP PCL 4, Adobe PostScript Level 2.

QMS 2025 Print System List price: \$12,995. 8MB SIMM, \$799; external 45MB hard disk, \$1,195; 250-sheet paper cassettes (letter-, legal-, executive-, and A4-size), \$120 each; 250-sheet B-size cassette, \$135; Connectivity options: same as for QMS 1725 Print System.

QMS 3225 Print System List price: \$19,995. Options: same as for QMS 2025 Print System.
Circle 510 on reader service card.

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Color Printers *A Spectrum Of Possibilities*



Stratification among color printers is diminishing as output quality and prices improve for every technology. These ten thermal dye transfer, thermal wax transfer, and ink jet printers bring color closer to the mainstream.

Color printing has come of age. As recently as last year, high-quality color printers ranged from expensive to very expensive, with list prices of \$4,995 and up. Even last year's worst color PostScript printer produced dramatically better output than the best color non-PostScript unit.

Over the past year, however, the depth and breadth of choices has increased dramatically, ranging from relatively inexpensive to expensive; from acceptable to dazzling color; from output suitable for business graphics to output ideal for photos; and from color only to color mixed with monochrome text.

LOWER PRICES ACROSS THE BOARD

List prices for this year's batch of color printers range from \$1,699 to just under \$10,000. Street prices dip well below \$2,000—and even to \$750 if you include the Fargo Primera Color Printer—a Microsoft Windows Graphics Device Interface (GDI) printer that uses the same thermal dye transfer technology higher-priced models use.

Part of the price-range expansion comes from the introduction of ink jet technology into the high-end color market—specifically the \$1,699 HP DeskJet 1200C and \$2,399 HP DeskJet 1200C/PS, from Hewlett-Packard Co., and the somewhat more expensive HP

by M. David Stone

PaintJet XL300 PostScript, at \$3,995. The latter two are reviewed in this section. The HP PCL 5-based DeskJet 1200C is identical to the DeskJet 1200C/PS in every way except for its lack of PostScript language support.

The market has also seen a 20 percent drop in price for thermal dye transfer (sometimes referred to as dye sublimation) and thermal wax transfer printers: Last year's list prices for thermal dye transfer printers were \$9,995 to \$11,900. Prices for the three thermal dye transfer printers reviewed this year—the Kodak ColorEase PS Printer, Seiko Instruments Professional ColorPoint PSH, and Tektronix Phaser IIIsdx—range from \$7,999 to \$9,999. (Note that the marketing research firm BIS Strategic Decisions predicts comparable drops next year.)

Similarly, last year thermal wax transfer printers listed for \$4,995 to \$9,995. This year's list prices are \$3,695 to \$5,995 for the three letter-size-only thermal wax

transfer printers reviewed—the QMS ColorScript 210, Tektronix Phaser 200e, and the Tektronix Phaser 200i. List prices are \$7,995 to \$8,995 for the two reviewed thermal wax transfer printers that can print on B-oversize paper—the

QMS ColorScript 230 and the CalComp ColorMaster Plus 6613XF.

REVIEW CRITERIA

To qualify for this category, a printer had to offer color output on at least letter-size (8.5- by 11-inch) paper and be priced over \$1,000. (See the ink jet section for a review of the HP DeskJet 550C, a color ink jet that lists for \$719 and sells for about \$600.) Since most of our color printing tests are PostScript-based, we required that the printer offer PostScript Level 1, 2, or both. Finally, the printer had to ship by late August 1993.

In addition to the reviews of the printers mentioned above, you'll find sidebars here on two non-PostScript printers that we thought too interesting to ignore—the

Kodak 450GL Digital Color Printer and the Fargo Primera Color Printer. The Kodak 450GL is a low-cost (\$1,599) thermal dye transfer printer that outputs postcard-size images for photo ID badges and other niche uses. The Primera, priced at only \$995, is a thermal wax transfer printer that uses the host PC's processor and memory to convert images into bitmaps that the printer can reproduce. By the time you read this, Fargo Electronics should be selling a kit for upgrading the Primera to thermal dye transfer.

Both are Windows printers, meaning that they come with drivers that work within Windows, and their low prices come mostly from their use of the PC as printer controller. They also use lower resolution than the 300 dots per inch that is standard for PostScript color printers.

One technology not represented here is solid ink—a variation on ink jet technology that melts solid ink instead of using liquid ink. The Tektronix Phaser III PXi, reviewed in last year's printer issue, uses this technology. There are two new solid ink printers that should be available by the time you read this. The \$4,995 Jolt PSe, from Dataproducts Corp., was not shipping at the time of our testing. The \$9,995 HS-1PS, from Brother International Corp., was shipping, but Brother

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HIGHLIGHTS

Color Printers

COLOR PRINTERS have matured substantially in the past year, and their business appeal is greater than ever. Prices have fallen dramatically even as output quality and speed have improved. Market segmentation is disappearing, leaving a spectrum of choices ranging in price from under \$2,000 to nearly \$10,000.

INK JET PRINTERS have offered passable color in the past, but they couldn't compete with more expensive color technologies. This year, the impressive HP DeskJet 1200C/PS shatters the stereotype, offering striking color output, speedy performance, and true Adobe PostScript Level 2 support for about \$2,000.

BETTER TEXT OUTPUT is a strength of this year's color printers. Even thermal dye transfer printers—historically weak for fine detail—show improvement. The DeskJet 1200C/PS ink jet printer, which unlike most color printers also prints in true (not process) black, produces crystal-clear black text with the 6-page-per-minute speed of a good laser printer.

THERMAL DYE TRANSFER still produces the best photo-realistic images, but it remains expensive. Thermal wax transfer and ink jet printers both excel at business graphics, with ink jets edging ahead for mixed text and graphics and thermal wax transfer units leading for network use. Solid-ink printers are

adept at handling unusual paper stock, but no new models were available for us to review. Dataproducts will be shipping a new solid ink printer, the Jolt PSe, by the time you read this.

TABLOID-SIZE COLOR PRINTING is possible with three of the ten reviewed models—the CalComp ColorMaster Plus 6613XF and QMS ColorScript 230 thermal wax transfer units, and the HP PaintJet XL300 PostScript ink jet printer. Tektronix has just announced its Tektronix Phaser 480, the first PC-compatible B-size thermal dye transfer printer (shipping next year). Be prepared to pay for the extra size: B-size printers cost about twice as much as comparable letter-size models.



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was unable to send us one in time for review. Unlike with the other color technologies, prices for solid ink printers have not changed since last year.

Seven other printers did not make it in time for testing or did not meet our criteria, but should be available by the time you read this. Three thermal wax transfer printers started shipping too late for inclusion in this overview: the General Parametrics Spectra*Star GT (\$4,495), the Seiko Instruments Color-Point PSN Model 4 (\$5,999), and its counterpart, the B-size ColorPoint PSN Model 14 (\$8,999).

Similarly, two thermal dye transfer printers were not shipping in time for our testing: the Shinko CHC-S746i Color-Stream/DS Plus (\$2,100), distributed by Mitsubishi International Corp., and the B-size Tektronix Phaser 480, priced at \$14,995. The Codonics NP-600 Photographic Network Printer was shipping, but Codonics did not supply one for review.

Finally, one color PostScript ink jet printer, Lexmark's IBM Color Jetprinter PS 4079 (\$3,199), met our criteria, but *PC Magazine* inadvertently did not review the product in time for publication. The IBM Color Jetprinter features 360-by-360 resolution, 144 color levels, and Color-Grade, a screening technique to produce quality halftones. Its score on our Graphics Speed test was 0.4 graphics pages per minute, roughly halfway between the two other PostScript ink jet printers tested, the DeskJet 1200C/PS (0.6 gppm) and the PaintJet (0.2 gppm). We reviewed the IBM Color Jetprinter in the First Looks section of *PC Magazine*, January 26, 1993.

REVISED RULES OF THUMB

Lower prices and a wider price spread are the most obvious changes in high-end color printers since last year. But if you haven't looked at these printers lately, you'll have to unlearn some of what you may already know.

For example, since thermal dye transfer printers smooth colors to yield continuous-tone output, they've also been known to blur edges on thin lines and text, making them unsuitable for business graphics. But that problem is essentially gone this year, as manufacturers have new



EDITORS' CHOICE

- *For business graphics — standalone or small workgroup* **HP DeskJet 1200C/PS**
- *For business graphics — workgroup* **Tektronix Phaser 200e**
Tektronix Phaser 200i
- *For photo-realistic output* **Kodak ColorEase PS Printer**
Tektronix Phaser IIsdx

With the diverse applications for which color output is used, it didn't make sense to select only one or two products for Editors' Choice recognition. Instead, we've chosen five printers, all exceptional in their respective fields. For truly photo-realistic output—still the pro-

vince of thermal dye transfer printers—past leader Tektronix offers the Tektronix Phaser IIsdx. Eastman Kodak Co., a newcomer to PC-based color printing, brings the Kodak ColorEase PS Printer.

When it comes to business graphics, the forte of thermal wax transfer printers, the Tektronix Phaser 200e and Tektronix Phaser 200i excel. But ink jet mogul Hewlett-Packard Co. threatens the Tektronix hegemony: The \$2,399 HP DeskJet 1200C/PS offers even better output and blazing text speed at a far lower price. Only the DeskJet 1200C/PS's lack of networking conveniences

kept it from completely outclassing the thermal wax transfer models.

MAINSTREAM CHOICES

The DeskJet 1200C/PS offers a previously unheard-of set of features: superb color and monochrome output, high performance, and a manageable price. It produces striking color output even on transparencies, typically a weak point for ink jet printers. It prints monochrome text at 6 pages per minute and with resolutions as high as 600 by 300 dots per inch. At a street price of around \$2,000 with a true Adobe PostScript Level 2 in-

algorithms designed specifically to handle lines and text. You shouldn't have reservations (other than the over-\$2.00 cost per image) about using them for business graphics as well as continuous-tone images.

Thermal wax transfer printers could always be counted on for fully saturated colors on transparencies. But business graphics on thick thermal paper stood out in a business report like heavy color plates in a book. Every thermal wax transfer printer in this year's batch, however, makes some attempt to print on more-or-less standard paper, ranging from copier paper to low-weight, uncoated thermal paper.

Ink jet printers have long had the opposite problem: While they produced good images on paper, they could not provide saturated colors on transparencies. The DeskJet 1200C/PS, however, prints

transparencies that are within striking distance of thermal wax transfer for fully saturated colors, and are preferable in some ways, since the dithering patterns are less obvious.

Solid ink printers are still the only choice for printing on any media whatsoever that can make it through their paper paths. But solid ink, because of its continued high price, is still a second choice to the newly versatile ink jets.

TEXT AND COLOR

When you include low-end dot matrix and ink jet technologies, there are two kinds of color printers: those suitable for both color and black printing, and those that always use the slow color process, even when printing in black. Some such printers actually make black by combining cyan, magenta, and yellow.

Until this year, all high-end color print-

terpreter, it's an unbeatable bargain. (A non-PostScript version, the HP DeskJet 1200C, is available for \$1,699 list (about \$1,299 on the street). We recommend this model for cost-conscious buyers.

The DeskJet 1200C/PS's only significant shortcoming is its limited networking savvy. It won't tell you when it's used up one color of ink, so it requires close monitoring. And as it doesn't support a second tray, you have to reload manually to switch between transparencies and paper.

If you want a printer that can produce colorful business graphics and is more network-friendly, the Phaser 200e (\$3,695) and Phaser 200i (\$5,995) thermal wax transfer printers are excellent choices. Both offer outstanding output quality (though not as impressive as that of the DeskJet 1200C/PS). The Phaser 200e is the least expensive thermal wax transfer printer we've seen. But the Phaser 200i is the fastest thermal wax transfer printer we've ever tested.

THERMAL DYE TRANSFER

If you need photo-realistic output, choosing between the \$7,999 ColorEase and the \$9,995 Phaser IIstdx could be difficult. Both generate superb output—significantly better than the Phas-

er IIstd, an Editors' Choice last year. The ColorEase did a slightly better job rendering flesh tones—not surprising, given Kodak's background in photography—while the Phaser IIstdx yielded marginally better detail in dark areas.

The ColorEase costs substantially less than the Phaser IIstdx, but the Phaser IIstdx was in some cases twice as fast—a difference that adds up quickly if you need to produce multiple proofs.

HONORABLE MENTIONS

Two of the color printers we tested fall slightly short in output quality but offer unique capabilities that merit honorable mention. For producing business graphics on B-size media, the CalComp ColorMaster Plus 6613XF (\$8,995) is a solid choice. For thermal dye transfer, B-size printing isn't yet a reality on the PC platform (although Tektronix has announced a B-size full-bleed printer, the Tektronix Phaser 480, shipping next year). The closest right now is the Seiko Instruments Professional ColorPoint PSH (\$9,999), which prints on B4-size (10.2- by 14.3-inch) stock and can produce full-bleed letter-size pages. Its output quality is good, though a step below that of the Phaser IIstdx and ColorEase.

SHARED FEATURES

As you might expect, there are several issues that apply across the entire category. The most obvious is PostScript itself. Of ten PostScript printers covered here,

six—HP's DeskJet 1200C/PS and PaintJet, Kodak's ColorEase, and Tektronix's Phaser 200e, 200i, and IIstdx—offer Adobe PostScript Level 2. The two QMS printers offer a proprietary QMS interpreter, with both Levels 1 and 2. The last two,

Seiko's ColorPoint and CalComp's ColorMaster offer non-Adobe PostScript interpreters with Level 1 support only.

All other things being equal, Adobe PostScript is more desirable than a non-

Adobe interpreter, and Level 2 is preferable to Level 1. But when choosing a printer, you should consider this issue only as a tiebreaker.

One last notable point is the easy setup of each of these printers. For thermal wax and thermal dye transfer printers, setup consists of installing the ribbon, loading the paper, and plugging the printer in. For ink jet printers, instead of installing the ribbon, you snap in four ink cartridges—one for each color. And remember that all of these color printers offer some level of network compatibility.

Finally, keep in mind that the most important issue in choosing a color printer is matching it to your output requirements. This year's batch of printers do a creditable job in a wider range than any before. But with four technologies to choose from, three of which are represented here, you should still pick whichever works best for your specific application.

CalComp Inc.

CalComp ColorMaster Plus 6613XF

BY ANGELA GUNN

The CalComp ColorMaster Plus 6613XF came close to the Tektronix Phaser 200e and Tektronix Phaser 200i in print quality and speed on our tests. Only its \$8,995 list price gave us pause. But once this relatively new printer is available at a lower-than-list street price, buyers looking for state-of-the-art thermal wax transfer printing should seek it out.

The ColorMaster Plus 6613XF is at the top of CalComp's line of color printers; it uses Intel's 80960CA 33-MHz controller and is built around CalComp's own 300-dot-per-inch engine. Other printers in the line include the ColorMaster 6603XF (\$5,995), which uses the same Intel controller but prints on A/A4-size paper, and the ColorMaster 6603PS (\$3,995), and ColorMaster 6613PS models (\$6,995), which use 16-MHz controllers.

The CalComp ColorMaster Plus 6613XF comes with 16MB of RAM (expandable to 64MB) and prints on letter, B-, A3-, A4-, and B-oversize media, all of which can be fed from the adjustable tray. The tray juts above the body of the print-

ers fell into the second category. As a practical matter you simply wouldn't use them for standard monochrome printing.

The DeskJet 1200C and DeskJet 1200C/PS deserve special mention for breaking that mold. Not only do they use black ink when printing monochrome, but they print at rates you would expect from a standard monochrome printer—6 ppm on our tests. That makes the DeskJet 1200C and DeskJet 1200C/PS the first in a new breed: single printers that have both fast text speed and high-quality color output. We hope to see more like them in the future.

*All other things being equal,
Adobe PostScript is more
desirable than a non-Adobe
interpreter, and Level
2 is preferable to Level 1.*

The BJC-600 Color Printer In Black And White.

At Canon®, we think that before you go out and buy a personal color printer for your home or small office, you should have all the facts in black and white. And have them right in front of you.

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Faster than you'd expect from a personal color printer. That's because the new BJC-600 print head has 192 color nozzles,

compared to as few as 48 on other personal color printers. And to further help speed it along, the BJC-600

is designed to print color in both directions



across the entire page.

Okay, how about all the little hidden costs?

Not here. The cost-per-page of the BJC-600 is a fraction of what you would normally pay for color printing.

Unlike most other color printers, the BJC-600 has 4 separate ink cartridges — one for each color. So when you run out of one color you don't have to replace all the others.

Finally, at less than \$649*, the Canon BJC-600 color printer will save you money right from the start.

To get the name of your nearest Canon dealer, call 1-800-848-4123.

Because now that you know the facts in black and white, it's time to see the BJC-600 in color.



Canon

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Benchmark Tests: Color Printers

The CalComp ColorMaster Plus 6613XF scored an impressive 2.0 graphics pages per minute on our Graphics Speed test, but it fell behind the Tektronix Phaser 200i and Tektronix Phaser 200e on our Microsoft Windows applications tests. The HP DeskJet 1200C/PS outpaced the HP PaintJet XL300 PostScript by a substantial margin.

How We Tested

Using the parallel port, we performed each speed test in PostScript mode.

The **Power Consumption** test measures the printer's energy usage under two conditions: when printing and when idle. For this test only, lower scores indicate better results.

The **Graphics Speed** test measures the printer's speed in producing two copies of a complex single-page graphic containing a TIFF image, horizontal and vertical gray scales, horizontal color scales, and line art.

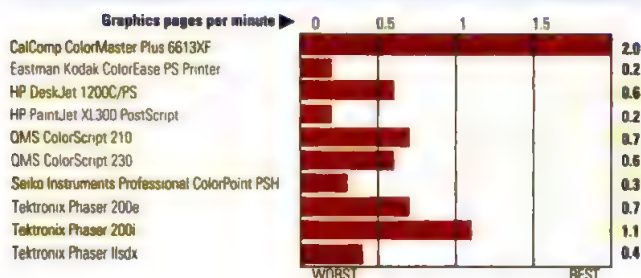
The **Lotus 1-2-3 for Windows** test measures the printer's speed in producing a complex two-page spreadsheet that has color pie, bar, and line charts. We tested each printer with the Windows driver recommended by the printer's manufacturer.

The **CorelDRAW** test measures the printer's speed in producing a single-page CorelDRAW graphic that contains a TIFF image, horizontal and vertical gray scales, and line art. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

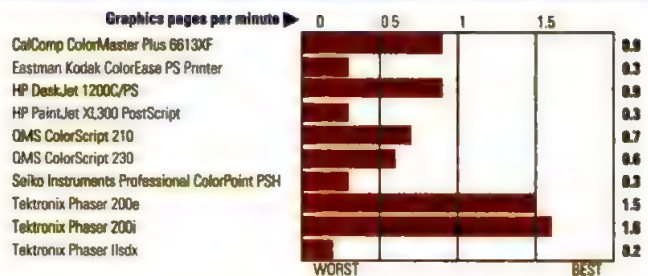
POWER CONSUMPTION

	Power consumption when printing (watts)	Power consumption at rest (watts)
CalComp ColorMaster Plus 6613XF	56	43
Eastman Kodak ColorEase PS Printer	69	47
HP DeskJet 1200C/PS	135	38
HP PaintJet XL300 PostScript	91	61
QMS ColorScript 210	55	37
QMS ColorScript 230	69	39
Seiko Instruments Professional ColorPoint PSH	110	57
Tektronix Phaser 200e	67	38
Tektronix Phaser 200i	88	45
Tektronix Phaser IIstdx	72	48

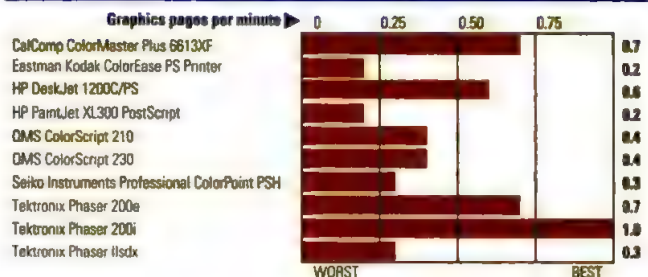
GRAPHICS SPEED



LOTUS 1-2-3 FOR WINDOWS



CORELDRAW



The HP DeskJet 1200/PS and Kodak ColorEase PS Printer produced unexpectedly strong and deep blues—typically difficult for color printers because of ink and dye limitations. Process black for most printers was nearly perfect, though the CalComp ColorMaster Plus 6613 and both QMS printers tended slightly toward blue, and the Tektronix Phaser 200e and Phaser 200i leaned toward green.

How We Tested

To determine each printer's range and purity of color, we printed a sample containing the primary CYM colors (cyan, yellow, and magenta), secondary RGB colors (red, green, and blue), and process and pure black (K). Pure black is available only on those printers that support four-pass ribbons or, in the case of ink jets, four colors of ink.

Using a Gretag SPM 50 spectrophotometer, we took color readings of the various output samples under fluorescent light, with the sample page placed over a white foam board to minimize the effects of paper translucence. Before we began each reading, the Gretag SPM 50 was calibrated to the paper on which the sample was printed, since each manufacturer supplies its own paper for its printers.

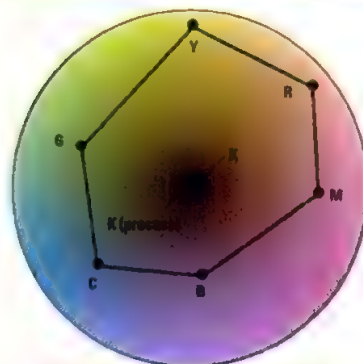
What It Means

The CIE (Commission Internationale de L'Eclairage) L.a.b. color space is a three-dimensional representation of color, including lightness. The circles of hues shown below are a slice of the CIE color space with the brightness component omitted.

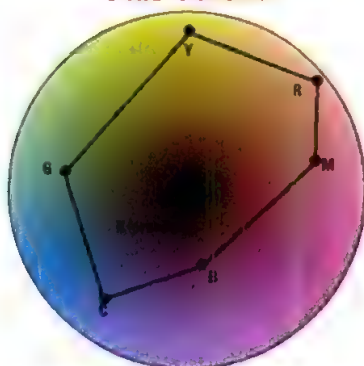
Using the results from the spectrophotometer, we superimposed our measurements of each sample color on the slice of color space. The position of the CYM, RGB, and K samples for each printer shows how it interprets each color.

For printers that were able to produce both process and pure black, we have indicated the results for both. Ideally, process and pure black should be close to indistinguishable.

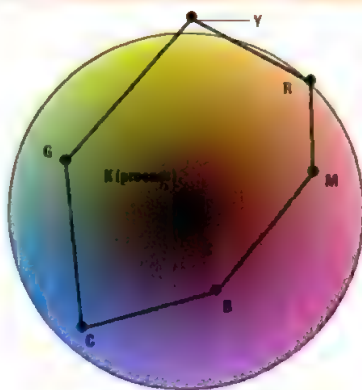
Selko Instruments Professional ColorPoint PSH



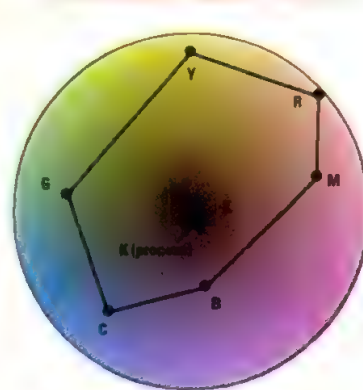
CalComp ColorMaster Plus 8618XF



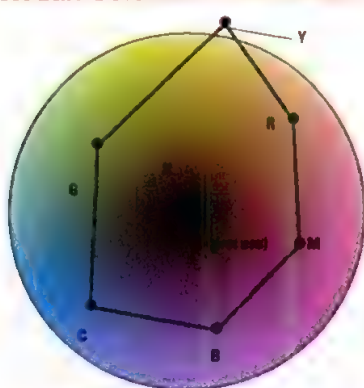
HP PaintJet XL300 PostScript



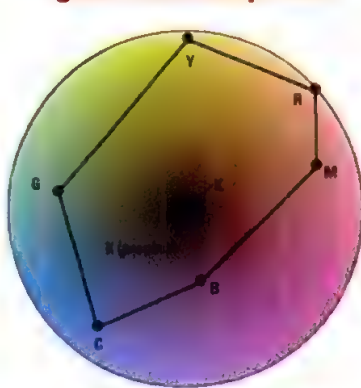
Tektronix Phaser 200e



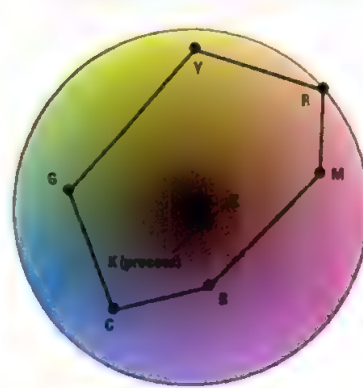
Kodak ColorEase PS Printer



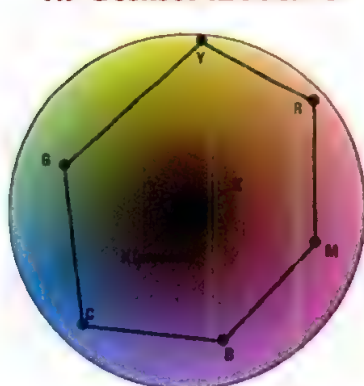
QMS ColorScript 210



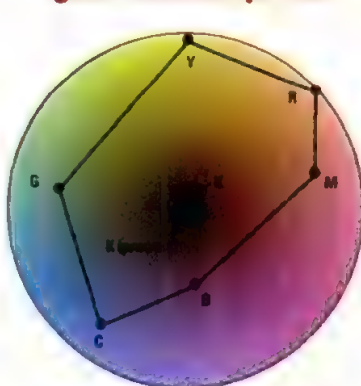
Tektronix Phaser 200i



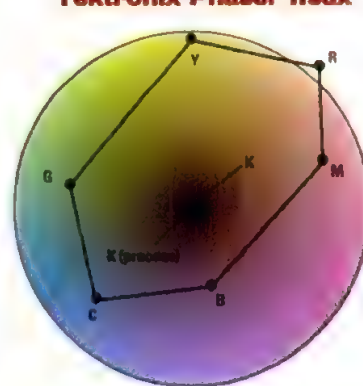
HP DeskJet 1200C/PS



QMS ColorScript 230



Tektronix Phaser IIedx



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Adobe

CIRCLE 368 ON READER SERVICE CARD

er, making the unit look something like a go-cart. The printer control panel is also rather odd and, with its unlabeled buttons and counterintuitive command sequences, it's difficult to use. But since the printer is largely self-adjusting—it can automatically sense, for example, whether it's handling paper or transparencies—you don't have to use the panel often.

Output quality was marvelous; we saw almost no banding or wax lift-off, and CalComp's enhancement technology helps minimize moiré patterns. The printer takes four-color ribbons, and it can also use black-only ribbons for specialized applications. The cost per page is reasonable at about 64 cents per color print on paper and \$1.43 on transparencies. Using the CalComp-supplied paper with tear-off strips ensures that margins will be no wider than 0.5 inch on all sides of the print image.

The ColorMaster Plus 6613XF is DOS- and Macintosh-compatible, with 39



standard Bitstream fonts; parallel, serial, and LocalTalk ports; and support for a SCSI-2 hard disk. Token-Ring connectivity is available through the standard parallel port; an Ethernet/EtherTalk interface is a \$995 option. Autosensing enables the printer to recognize data arriving from multiple platforms.

CalComp Inc., 2411 W. La Palma Ave., Anaheim, CA 92801; 800-225-2667, 714-821-2800; fax, 800-932-1212.

ColorMaster Plus 6613XF List price: \$8,995; 8MB RAM upgrade, \$695; 16MB RAM upgrade, \$1,995; 32MB RAM upgrade, \$1,995; black ribbon, \$110; three-color ribbon, \$101; four-color ribbon, \$93; Ethernet network interface card, \$995; paper: 300 letter-size sheets, \$34; 300 B-size sheets, \$48; transparencies: 100 letter-size sheets, \$90; 100 B-size sheets, \$160. Emulations: PhoenixPage PostScript Level 2. Circle 460 on reader service card

Hewlett-Packard Co.

HP DeskJet 1200C/PS

HP PaintJet XL300 PostScript

BY M. DAVID STONE

Hewlett-Packard Co. is the dominant player in the ink jet market, so it shouldn't be a surprise that the company's high-end color printers both employ ink jet technology. The new, \$3,995 HP PaintJet XL300 PostScript printer adds Adobe PostScript Level 2 to the B-size HP PaintJet XL300 (now \$2,795), which won an Editors' Choice last year. The \$2,399 (list) HP DeskJet 1200C/PS is even better than the PaintJet XL300, with spectacular color

output, good performance, and reasonable prices for consumables. This printer is also available in an HP PCL-only version—the \$1,699 HP DeskJet 1200C—which we didn't test, since the DeskJet 1200C/PS offers a superset of its features.

The PaintJet XL300 and the DeskJet 1200C/PS share little beyond their support for color HP PCL 5, HPGL/2, and true Adobe PostScript Level 2 with 35 built-in fonts. By far the more exciting of the two products is the DeskJet 1200C/PS, which you can buy for its high-quality text output but use for its exceptional color capabilities. This is one of the few color printers that doesn't hedge on monochrome output quality. Text in high-quality mode is produced crisply at 600- by 300-dot-per-inch resolution; graphics resolution is 300- by 300-dpi only.

The DeskJet 1200C/PS's color output far outshines that of other ink jets, and is better than that of most thermal wax transfer printers. Even transparencies are created with fully saturated,

vibrant color. And although a dithering pattern is evident, scanned photos come close to a photo-realistic look.

Rated speed for color graphics is 2 minutes per page (0.5 graphics pages per minute); we measured it at about 0.8 gppm in HP PCL 4 mode and about 0.6 gppm in PostScript mode. Text speed was impressive at 6.2 ppm in PCL mode and 5.7 ppm in PostScript mode.

Ink cost per page ranges from 12 cents for 25 percent coverage to 49 cents for 100 percent coverage. You can use copier paper with good results; otherwise, add \$1.20 a page for glossy paper, 11 cents per page for clay-coated paper, or \$1.12 per page for transparencies. The paper tray holds 180 sheets of letter-, legal-, or A4-size paper; a manual feed slot accommodates

The HP DeskJet 1200C/PS, which has exceptional color capabilities, also doesn't hedge on monochrome output quality.

envelopes. Networking options are available, but the DeskJet 1200C/PS needs close monitoring as a network printer. It will continue to print even if it runs out of one color of ink. And since a second media tray isn't an option, you cannot keep transparencies and paper loaded simultaneously.

The DeskJet 1200C/PS has a street price of about \$1,800 to \$2,000. If you don't need PostScript, however, consider the DeskJet 1200C, which comes with 2MB of RAM and PCL 5 support only but is otherwise identical. HP expects to sell more units of the DeskJet 1200C than of the DeskJet 1200C/PS; the DeskJet 1200C has a street price of \$1,299 and can be upgraded to the DeskJet



1200C/PS with a \$729 SIMM.

HP's other high-end color printer is the B-size PaintJet XL300. It comes with 6MB of RAM, but simply isn't in the same league as the DeskJet 1200C/PS. It prints text slowly (less than 1 ppm), produces far less attractive color output, and costs more to run: 39 cents per page at 25 percent coverage, and \$1.56 for complete coverage. It also costs more to purchase, with a street price of \$3,000 to \$3,150.

If you need to print on B-size paper, the PaintJet XL300 will do it. But for almost all other applications, the DeskJet 1200C/PS is a better choice.

Hewlett-Packard Co., P.O. Box 58059, MS-511L-SJ, Santa Clara, CA, 95051-8059; 800-752-0900; fax, 208-344-4809.

EDITORS' CHOICE ► HP DeskJet 1200C/PS List price: \$2,399; 1MB RAM upgrade, \$109; 2MB RAM upgrade, \$189; 4MB RAM upgrade, \$279; 8MB RAM upgrade, \$539; LaserJet font cartridges, \$195 to \$215; HP JetDirect network cards, \$185 to \$699; black cartridge, \$29.95; color cartridge, \$34.95 per single-color; paper: 50 glossy letter- or A4-size sheets, \$59.95; 200 coated letter-size sheets, \$20.95; 200 coated A4-size sheets, \$22.95; transparencies: 50 letter- or A4-size sheets, \$55.95. Emulations: Adobe PostScript Level 2, color HP PCL 5, HPGL/2.

Circle 462 on reader service card

HP PaintJet XL300 PostScript List price: \$3,995; 1MB RAM upgrade, \$109; 2MB RAM upgrade, \$189; 4MB RAM upgrade, \$279; 8MB RAM upgrade, \$539; LaserJet font cartridges, \$195 to \$215; 200-page/100-transparency cassettes (A3-, B-, B4-size), \$129 to \$149; additional letter-, A4-, or legal-size input tray, \$89; HP JetDirect network cards, \$185 to \$699; black ink cartridge, \$22.95; color cartridge, \$25.95 per color; paper: 50 glossy letter- or A4-size sheets, \$59.95; 200 coated letter-size sheets, \$20.95; 200 A4-size coated sheets, \$22.95; transparencies: 50 letter- or A4-size sheets, \$55.95. Emulations: Adobe PostScript Level 2, color HP PCL 5, HPGL/2.

Circle 463 on reader service card

Price Comparison: A Look at Per-Page Costs

In this chart we list total printing costs per page for the ten reviewed color printers. Because the cost of special paper required by most color printers is considerable, we have included it in these calculations. In cases where a printer uses standard photocopier paper, we have assumed a cost of 1 cent per sheet.

For ink jet printers, the cost per page varies depending on the amount of ink coverage; here we estimate cost at 25 percent and 100 percent coverage using figures provided by Hewlett-Packard Co. For other technologies represented here, cost per page is constant regardless of color coverage.

		Cost per page	
		Paper	Transparency
LETTER-SIZE OUTPUT			
CalComp ColorMaster Plus 6613KF	Three-color ribbon	\$0.60	\$1.39
	Four-color ribbon	\$0.64	\$1.43
Eastman Kodak ColorEase PS Printer	Three-color ribbon	\$2.10	\$2.80
	Four-color ribbon	\$2.10	\$2.80
HP DeskJet 1200C/PS	25 percent ink coverage	\$0.13	\$1.32
	100 percent ink coverage	\$0.50	\$1.69
HP PaintJet XL300 PostScript	25 percent ink coverage	\$0.40	\$1.58
	100 percent ink coverage	\$1.57	\$2.76
QMS ColorScript 210	Three-color ribbon	\$0.57	\$1.54
	Four-color ribbon	\$0.63	\$1.60
QMS ColorScript 230	Three-color ribbon	\$0.68	\$1.65
	Four-color ribbon	\$0.68	\$1.65
Seiko Instruments Professional ColorPoint PSH	Three-color ribbon	\$2.50	\$3.90
	Four-color ribbon	\$4.50	\$5.90
Tektronix Phaser 200e	Three-color ribbon	\$0.56	\$1.60
	Three-color ribbon with plain-paper coat	\$0.60	\$1.71
Tektronix Phaser 200i	Three-color ribbon	\$0.56	\$1.60
	Three-color ribbon with plain-paper coat	\$0.60	\$1.71
Tektronix Phaser II/dx	Three-color ribbon	\$2.25	\$3.25
	Four-color ribbon	\$2.75	\$3.75
B-SIZE OUTPUT			
CalComp ColorMaster Plus 6613KF	Three-color ribbon	\$0.65	\$2.09
	Four-color ribbon	\$0.69	\$2.13
HP PaintJet XL300 PostScript	25 percent ink coverage	\$0.80	N/A
	100 percent ink coverage	\$3.14	N/A
QMS ColorScript 230	Three-color ribbon	\$0.74	\$1.85
	Four-color ribbon	\$0.74	\$1.85

N/A—Not applicable. The company does not sell B-size transparencies

Eastman Kodak Co.

Kodak ColorEase PS Printer

BY M. DAVID STONE

The \$7,999 Kodak ColorEase PS Printer is Eastman Kodak Co.'s first PostScript color printer, although the company has been

making high-end color printers since 1986. Appropriately, the ColorEase is a thermal dye transfer printer that produces photo-realistic output.

This printer's most prominent features are its superb output and

low price. With street prices of \$6,500 to \$7,000, it costs \$2,000 less than other thermal dye transfer products. The ColorEase also costs less to use, at \$2.10 per page or \$2.60 per transparency.



Yet saving doesn't mean sacrifice: Output quality is among the best we've seen for this type of printer. Printed copies of photos could pass for darkroom-developed prints. Business graphics reproduce with fully saturated colors—on transparencies or paper. With its 300-dot-per-inch resolution, the ColorEase also renders thin lines and text crisply. The printer includes an Adobe PostScript Level 2 interpreter and UltraColor, UltraColor Plus, and ColorSense (Macintosh only) color-matching features.

Other standard components include 16MB of RAM (not expandable) and a 120MB internal hard disk—70MB of which is used for virtual RAM, effectively creating 86MB of memory. Interfaces include parallel, serial, and LocalTalk ports, plus two SCSI ports, both of which can connect to additional hard disks for font storage. An EtherTalk port is a \$495 option. Paper handling is limited to one letter-size tray or an optional A4-size tray (\$140), each with a capacity of 100 sheets of paper or transparencies.

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■ **Primera:** *Hot Color Under \$1,000*

by M. David Stone

The Fargo Primera Color Printer, from Fargo Electronics, is the only thermal wax transfer printer available for under \$1,000 and the only one that can be upgraded to thermal dye transfer. What's the trick? The Primera is a Microsoft Windows GDI (Graphics Device Interface) color printer; it lacks its own controller and offers no support for PostScript or any other page description language. Instead, a software driver on the host PC converts graphics from Windows' native format into bitmaps, which the printer outputs directly.

GDI printing's promise is true WYSIWYG output with reduced hardware costs. The absence of a standard emulation isn't a problem if you don't need PostScript proofing capabilities and only print from Windows (Macintosh and Commodore Amiga drivers are also provided). The Primera can print whatever Windows can display: any TrueType font and, with Adobe Type Manager, any Type 1 font.

Fargo specializes in dedicated label printers; the company is new to the PC color-printer market. But the \$995 Primera cuts the right corners to reach its price (about \$750 to \$850 on the street). Its 203- by 203-dot-per-inch resolution, for instance, results in slightly jagged edges on curves and diagonals. You still get fully saturated colors, though, and the output looks far better than you'd expect for the price.

The Primera's performance depends on your computer's speed, since graphics rasterization is performed on the host PC. You can improve the printer's performance by using a faster PC, although the print engine's maximum speed is 2.5 minutes per page. The Primera accepts

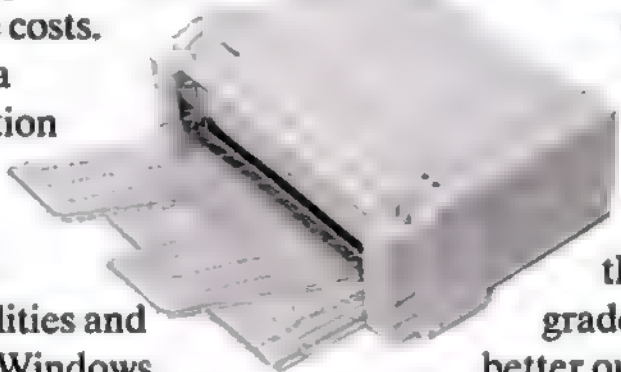
50 sheets of paper or 30 transparencies. Operating costs start at only 47 cents per page or \$1.09 per transparency.

Sample output provided by Fargo was a soft-focused step below 300-dpi thermal dye transfer printers, but better than color output generated by any other technology at any price. A \$249.95 thermal dye transfer upgrade—not available in time for testing—should make the Primera's output even better. The upgrade consists only of supplies and software, including a driver which controls the speed of the stepper motor and the heating of the printhead. Performance with the thermal dye transfer option installed is rated at 7 minutes per page; cost per image (on paper) is \$2.80.

With or without the thermal dye transfer upgrade, the Primera offers far better output than any printer you'll find at this price. For budget Windows-based color printing, the Primera is an excellent choice. □

Fargo Electronics Inc., 7901 Flying Cloud Dr., Eden Prairie, MN, 55344; 800-327-4622, 612-941-9470; fax, 612-941-7836.

Fargo Primera Color Printer List price: \$995; *single-color ribbon*, \$39.95; *three- or four-color ribbon*, \$45; *thermal wax transfer paper*: 200 letter-size sheets, \$14.95, 200 A4-size sheets, \$15.95; *premium-grade paper*: 200 letter-size sheets, \$19.95, 200 A4-size sheets, \$20.95, 200 perforated letter-size sheets, \$21.95; *transparencies*: 50 letter-size sheets, \$34.95, 50 A4-size sheets, \$36.95; *thermal dye transfer upgrade*, \$249.95; *thermal dye transfer refill kit with ribbon and paper*: for 25 images, \$89.95 (letter) or \$92.95 (A4), for 100 images, \$249.95; *Macintosh interface kit*, \$199.95; *Emulations*: None (prints directly from Microsoft Windows). Circle 501 on reader service card



The printer is driven by a 40-MHz SPARC RISC processor, which Kodak says can process one job while actively printing another. On our tests, though, speed wasn't exceptional: The printer produced 0.22 graphics pages per minute, slightly below the 3.5-minute-per-page rating of its Kodak engine, and somewhat slower than the Tektronix Phaser IIsdx. Still, the ColorEase PS Printer generates output comparable with that of the Phaser IIsdx, and it costs substantially less.

Eastman Kodak Co., 901 Elmgrove Rd., Rochester, NY 14653; 800-344-0006, 716-724-4000.

EDITORS' CHOICE ► **Kodak ColorEase PS Printer** List price: \$7,999; *additional 100-sheet letter- or A4-size tray*, \$140; *three-color ribbon*, \$145; *EtherTalk port*, \$495; *paper*: 100 letter-size sheets, \$65; 100 A4-size sheets, \$75; *transparencies*: 100 letter-size sheets, \$115; 100 A4-size sheets, \$135. *Emulations*: Adobe PostScript Level 2.

Circle 461 on reader service card

QMS Inc.

QMS ColorScript 210

QMS ColorScript 230

BY ANGELA GUNN

The QMS ColorScript 230 (a \$7,995 thermal wax transfer unit) and the QMS ColorScript 210 (its smaller, \$4,995 sibling) are capable printers, but their print quality pales when compared with that of newer thermal wax transfer units. The ColorScript 230 offers B-size output capability; the ColorScript 210 prints only on letter- or legal-size sheets, and even then with wide margins.

Both QMS printers use an Intel 80960CA 25-MHz RISC controller and include 65 PostScript fonts. Two slots for font or emulation cards are standard on each printer; an optional \$250 QMS security card keeps users from tinkering with configurations.

Since the ColorScript 210 doesn't use paper with tear-off strips, the printable area is only 8.1 by 9 inches on letter-size paper; legal-size paper is the largest format supported. The paper tray has a 50-page or 30-transparency capacity. Cost per page on paper is 63 cents; on trans-

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- DataRace™ PCMCIA Modem 9.6 data/9.6 fax
- Cellular Interface Cable (Connects AT&T modem to cellular phone)
- PCMCIA 10Base2 Network Interface Card
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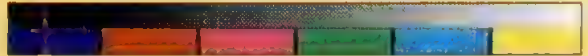
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CalComp ColorMaster Plus 6613XF

\$8,995

B-size thermal wax transfer printer (CalComp 6613XF engine) with 33-MHz Intel 80960CA RISC processor and PhoenixPage PostScript compatibility



PS WINDOWS APPLICATIONS:
CorelDRAW: 0.7 gppm
Lotus 1-2-3 for Windows: 0.9 gppm

PS Graphics Speed: 2.0 gppm



Eastman Kodak ColorEase PS Printer

\$7,999

Thermal dye transfer printer (Kodak ColorEase engine) with 40-MHz Sun SPARC RISC processor and Adobe PostScript Level 2 interpreter



PS WINDOWS APPLICATIONS:
CorelDRAW: 0.2 gppm
Lotus 1-2-3 for Windows: 0.3 gppm

PS Graphics Speed: 0.2 gppm



HP DeskJet 1200C/PS

\$2,399

Ink jet printer (HP DeskJet 1200C engine) with 11-MHz Intel 80960SA RISC processor, color HP PCL 5, and Adobe PostScript Level 2 interpreter



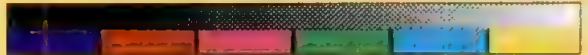
PS WINDOWS APPLICATIONS:
CorelDRAW: 0.6 gppm
Lotus 1-2-3 for Windows: 0.9 gppm

PS Graphics Speed: 0.6 gppm

HP PaintJet XL300 PostScript

\$3,995

B-size ink jet printer (HP PaintJet XL300 engine) with 10-MHz Intel 80960 RISC processor, color HP PCL 5, and Adobe PostScript Level 2 interpreter



PS WINDOWS APPLICATIONS:
CorelDRAW: 0.2 gppm
Lotus 1-2-3 for Windows: 0.3 gppm

PS Graphics Speed: 0.2 gppm

QMS ColorScript 210

\$4,995

Thermal wax transfer printer (Mitsubishi 3710 engine) with 25-MHz Intel 80960CA RISC processor and QMS PostScript



PS WINDOWS APPLICATIONS:
CorelDRAW: 0.4 gppm
Lotus 1-2-3 for Windows: 0.7 gppm

PS Graphics Speed: 0.7 gppm

QMS ColorScript 230

\$7,995

B-size thermal wax transfer printer (Mitsubishi 6710 engine) with 25-MHz Intel 80960CA RISC processor and QMS PostScript



PS Graphics Speed: 0.6 gppm

PS WINDOWS APPLICATIONS:
CorelDRAW: 0.4 gppm
Lotus 1-2-3 for Windows: 0.6 gppm

Seiko Instruments Professional ColorPoint PSH

\$9,999

Thermal dye transfer printer (Seiko CH6104-PSH engine) with 25-MHz Weitek XL 8220 RISC processor and Prime Option PostScript



PS Graphics Speed: 0.3 gppm

PS WINDOWS APPLICATIONS:
CorelDRAW: 0.3 gppm
Lotus 1-2-3 for Windows: 0.3 gppm



Tektronix Phaser 200e

\$3,695

Thermal wax transfer printer (Sharp TK4681 engine) with 16-MHz AMD 29000 RISC processor and Adobe PostScript Level 2 interpreter



PS Graphics Speed: 0.7 gppm

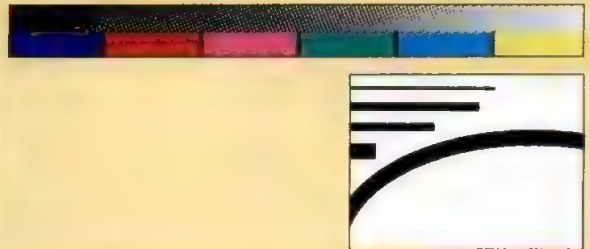
PS WINDOWS APPLICATIONS:
CorelDRAW: 0.7 gppm
Lotus 1-2-3 for Windows: 1.5 gppm



Tektronix Phaser 200i

\$5,995

Thermal wax transfer printer (Sharp TK4681 engine) with 24-MHz AMD 29000 RISC processor and Adobe PostScript Level 2 interpreter



PS Graphics Speed: 1.1 gppm

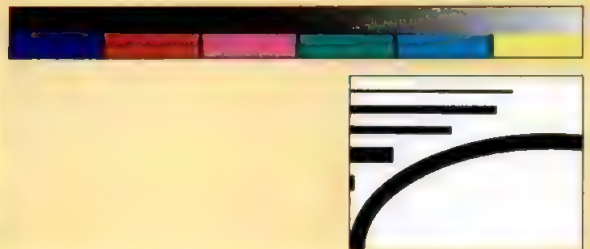
PS WINDOWS APPLICATIONS:
CorelDRAW: 1.0 gppm
Lotus 1-2-3 for Windows: 1.6 gppm



Tektronix Phaser IIidx

\$9,995

Thermal dye transfer printer (Sharp TK4684 engine) with 24-MHz AMD 29000 RISC processor and Adobe PostScript Level 2 interpreter



PS Graphics Speed: 0.4 gppm

PS WINDOWS APPLICATIONS:
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Lotus 1-2-3 for Windows: 0.2 gppm

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Source: MWA Consulting, Inc., August 1993.



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May 25, 1993

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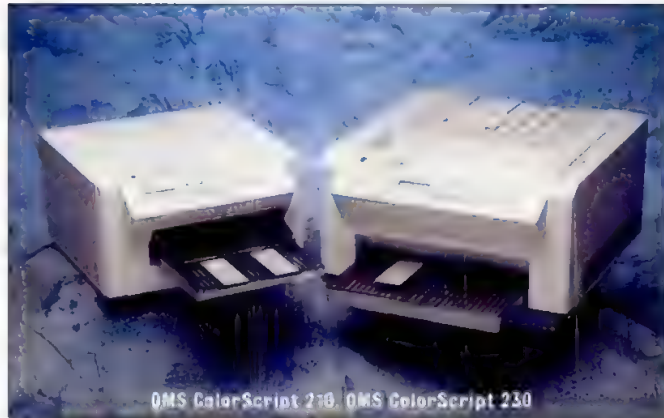
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parencies the cost is \$1.60.

The ColorScript 230, by contrast, can print on nearly the entire page. The typical cost per page is 68 cents for A-size paper, 74 cents for B-size paper, and about \$1.00 more per page for transparencies. The standard paper tray can hold 180 pages or 100 transparencies.

Both printers' speeds were about average, but their output was generally poor. Severe banding was evident in color gradients, and we found tiny areas where one color of wax lifted off the paper during application of another color, and pronounced moiré patterns obscured fine detail in photographic images. Even if you can find these QMS printers at 25 percent below list, the Tektronix Phaser 200e and 200i give you more for less money.

QMS Inc., One Magnum Pass, Mobile, AL 36618; 800-633-2696, 205-639-4400;



fax, 205-633-4866.

QMS ColorScript 210 List price: \$4,995; RAM upgrades: 4MB, \$459; 8MB, \$799; 45MB SCSI hard disk, \$1,195; network interface: Ethernet, \$895; Token-Ring, \$1,095; DECnet, \$1,395; paper: 1,000 letter- or A4-size sheets, \$80; 2,000 letter- or A4-size sheets, \$125; 1,000 legal- or special A4-size sheets, \$110; 2,000 legal- or special A4-size sheets, \$175;

transparencies: 100 letter- or A4-size sheets, \$105; 100 legal- or special A4-size sheets, \$125; one-, three-, or four-color ribbon, \$82.50. Emulations: HPGL, QMS PostScript Level 2.

Circle 464 on reader service card

QMS ColorScript 230 List price: \$7,995; RAM upgrades: 4MB, \$459; 8MB, \$799; network interface: same options and prices as QMS ColorScript

210; security card, \$250; paper: same as ColorScript 210, plus 1,000 B-size sheets, \$135; 2,000 B-size sheets, \$220; transparencies: same as ColorScript 210, plus 100 B- or A3-size sheets, \$160; one-color or four-color A/B-size ribbon, \$120; one-color or four-color oversize-B ribbon, \$240. Emulations: HPGL, QMS PostScript Level 2.

Circle 465 on reader service card

■ Kodak 450GL: Postcard-Size Photos

by M. David Stone

The Kodak 450GL Digital Color Printer, from Eastman Kodak Co., doesn't fit into any of our usual categories—it doesn't support any common page description language and it won't print even letter-size output.

Instead, this thermal dye transfer printer is intended for niche applications that require small-format color prints. According to Kodak, it is commonly used to produce photo ID badges and pictures of properties for sale. With its list price of \$1,599 and a typical street price from \$1,200 to \$1,500, the Kodak 450GL is far less expensive than almost any other thermal dye transfer printer available on the market today. (The exception is Fargo Electronics' Primera Color Printer, which costs about \$1,250 with an optional thermal dye transfer upgrade kit.)

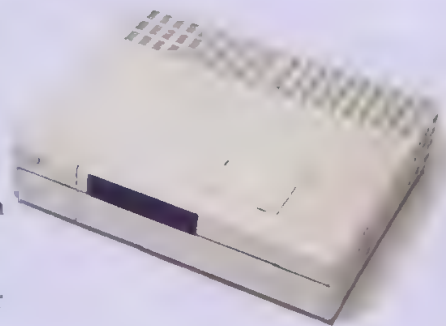
The manufacturer manages to charge this lower price by equipping the Kodak 450GL with fewer features than most thermal dye transfer printers have. To begin with, the Kodak 450GL

has only a 137- by 111-dot-per-inch resolution, which is a far cry from the 300- by 300-dpi resolution that is common among more expensive thermal dye transfer units. And it only prints on A6-size stock, which at 4 by 5.5 inches is about the size of a postcard. The maximum image size is an even smaller 3.4 by 4.6 inches.

The Kodak 450GL is a raster printer, which means it prints only rasterized (bitmapped) images or text. That in turn means you can only print with programs for which Kodak provides a driver. For PC applications, that limits you to Microsoft Windows. (A driver for the Apple Macintosh is also available.)

On the plus side, the Kodak 450GL is inexpensive to run. A package containing a ribbon and 50 sheets of paper sells for \$46.95, or just 94 cents per print—less than half the price charged for supplies of high-end thermal dye transfer printers.

The printer's grainy output can't compare with that of the 300-dpi thermal dye transfer models we reviewed for this issue. The images the Kodak



450GL produces, however, are adequate for the specialized applications toward which the product is targeted. And although the Kodak 450GL is not designed to be a mass-market product, it may provide the foundation for future products that could, for example, produce 300-dpi full-color prints of Photo CD images.□

Eastman Kodak Co., 901 Elmgrove Rd., Rochester, NY 14653; 800-344-0006, 716-724-4000; fax, 716-726-3758.

Kodak 450GL Digital Color Printer List price: \$1,599; ribbon and paper for 50 images, \$46.95; Macintosh interface and driver, \$229. Emulations: None (includes proprietary Microsoft Windows driver).

Circle 502 on reader service card

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CIRCLE 187 ON READER SERVICE CARD

Canon

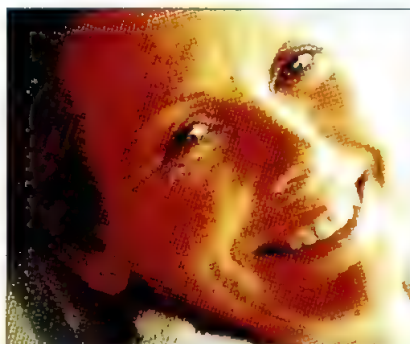
■ Color Output: *Comparing the Results*

Below are actual-size reproductions of output from nine reviewed printers. The thermal dye transfer printers produced the best results, followed closely by the HP DeskJet 1200C/PS.

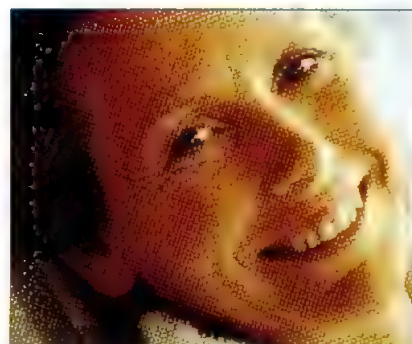
THERMAL WAX TRANSFER



CalComp ColorMaster Plus 6613XF • \$8,995



QMS ColorScript 210 • \$4,995



Tektronix Phaser 200e • \$3,695

THERMAL WAX TRANSFER



Tektronix Phaser 200i • \$5,995



HP DeskJet 1200C/PS • \$2,399



HP PaintJet XL300 PostScript • \$3,995

INK JET

THERMAL DYE TRANSFER



Kodak ColorEase PS Printer • \$7,999



Seiko Professional ColorPoint PSN • \$9,999



Tektronix Phaser IIadx • \$9,995

Seiko Instruments USA Inc.

Seiko Instruments Professional ColorPoint PSH

BY M. DAVID STONE

Seiko Instruments USA has been in the high-end color printer business since 1982, but the Seiko Instruments Professional ColorPoint PSH is its first PostScript-compatible thermal dye transfer printer. The \$9,999 ColorPoint is typically available for \$8,000 to \$9,000; when it was introduced in January it was one of the best available—comparable with the 1992 Editors' Choice Tektronix Phaser IIsd. Against today's tougher competition, though, the ColorPoint's features and output quality are closer to average.

The printer's strongest point is its ability to print letter-size full bleeds on B4-size stock for images of 8.5 by 11.9 inches. But the acid test for a 300- by 300-dot-per-inch thermal dye transfer printer is output quality—and on our tests, using the ColorPoint's default settings, its prints of photos were somewhat dark. The output was attractive but didn't compare well with the more detailed output of the Eastman Kodak and Tektronix units. Business graphics printed with fully saturated colors and crisp edges for both text and lines. Price per image for the three-pass ribbon ranges from \$2.50 for letter-size paper to \$3.90 for transparencies; add about \$2.00 for the four-pass ribbon.

Printing speed was clocked at 0.3 graphics pages per minute, slightly faster than the worst-case rating of 4 minutes per page, but not as fast as the comparably priced Tektronix Phaser IIsdx. The ColorPoint's PostScript interpreter is provided by Prime Option.

The ColorPoint's engine is Seiko's CH6104-PSH, with a 25-MHz Weitek XL 8220 processor on-board. The standard 16MB of RAM is expandable to 64MB; also standard are parallel, serial, and

LocalTalk ports. A \$679 upgrade lets you connect to a variety of networks.

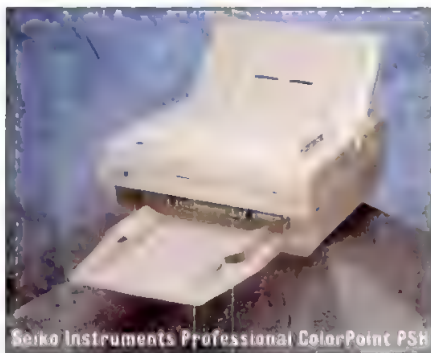
For producing letter-size bleeds, the ColorPoint offers an adequate complement of features.

Seiko Instruments USA Inc., 1130 Ringwood Ct., San Jose, CA 95131; 800-888-0817, 408-922-5900; fax, 408-922-5835.

Seiko Instruments Professional ColorPoint PSH List price: \$9,999; 16MB RAM upgrade, \$2,400; one-color

ribbon, \$300; three-color ribbon, \$195, four-color ribbon, \$295; network interface (supports Ethernet, Ethernet TCP/IP, AppleTalk/EtherTalk, DEC LAT, Unix "lpd"), \$679; paper: 100 letter-size sheets, \$55; 100 A4-

size sheets, \$135; 100 legal-size sheets, \$115; 100 B4-size sheets, \$155; transparencies: 100 letter-size sheets, \$195. Emulations: Prime Option PostScript. Circle 466 on reader service card



Tektronix Inc.

Tektronix Phaser 200e Tektronix Phaser 200i Tektronix Phaser IIsdx

BY M. DAVID STONE

Tektronix printers have always been among the best of the breed, a tradition maintained by current models that couple brilliant color with speed. The \$9,995 Tektronix Phaser IIsdx (street price of

about \$9,250) is a faster version of the Tektronix Phaser IIsd thermal dye transfer printer—a 1992 Editors' Choice. The \$3,695 Tektronix Phaser 200e (street price of about \$3,500) is a budget-priced thermal wax transfer unit. The \$5,995 Tektronix Phaser 200i (street price of about \$5,500) adds sports-car speed to the Phaser 200e. Tektronix still sells its solid-ink Tektronix Phaser III PXi, which won an Editors' Choice last year.

The three new printers share some features, including 300-dot-per-inch resolution, Adobe PostScript Level 2, and AMD 29000 RISC processors—16 MHz in the Phaser 200e and 24 MHz in the Phaser 200i and Phaser IIsdx.

The Phaser 200e and Phaser 200i are built around the same Sharp TK4681 engine, rated at 0.5 minutes per page using a three-pass ribbon and 0.75 minutes per page with a four-pass ribbon that coats standard paper on the first pass. Output quality for both printers was generally good, with fully saturated, brilliant color for business graphics and crisp, clean lines for text and graphics. In mixed colors and shades of gray, dithering was obvious. Per-page costs for color images are about \$0.60 for paper and around \$1.60 for transparencies.

The standard paper tray holds 100 letter- or A4-size sheets or 50 transparencies. An optional \$500 bottom feeder has a second tray, so you can load both transparencies and paper.

The Phaser 200e comes with 4MB of RAM and 17 fonts; an upgrade to its 8MB maximum (\$495) buys you 22 more fonts. Its speed was reasonable at about 90 seconds per page.

The Phaser 200i is a souped-up Phaser 200e, incorporating a 24-MHz processor, 6MB of RAM (expandable to 14MB), and 39 fonts. The swift Phaser 200i produced our test page in less than a minute.

Tektronix's high-end product is the thermal dye transfer Phaser IIsdx. Its output is stunning: Scanned photos rival photographic prints,



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The four- or five-digit number next to each product is the product's ITEM NUMBER. Please refer to this number when ordering. Thank you.

We carry only the latest versions of products. Version numbers are current at press time. Products listed here in red are Microsoft Windows Applications.

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3532	CE Power Pak (3 1/2" only).....	79.
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2426	Quicken 7.0... 39.	5596 3.0 for Windows 39
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6882	PrintCache 3.1	59.
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3217	QEMM 7.0 (3221 5/4") 59.
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10868	WinSense 2.0 42
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1409	Stacker 3.1 95
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5136	The Norton Utilities 7.0 (3146 5/4") 115.
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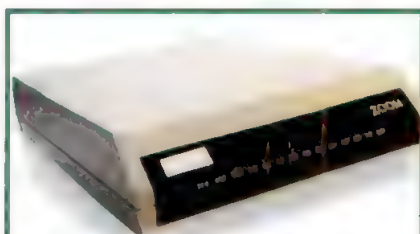
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10957	Windows Membership Kit 1.0 (3 1/4" only)..... 27
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5611	Crosstalk 2.0 for Windows 119
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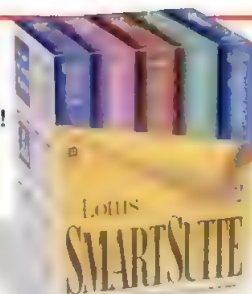
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1603 DG60M (2 yr.)..... 12. 2520 DG90M (2 yr.)... 15.

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1581 DC2120 Cartridge..... 22. 11013 (3 pack)..... 60.

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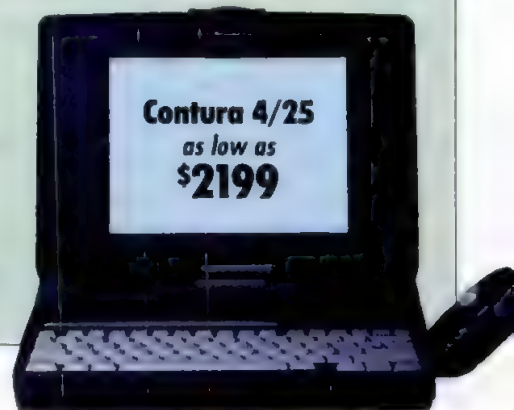
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NiCd Battery, MS-DOS and Windows 3.1\$2199

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► SUMMARY OF FEATURES

Color Printers



Products listed in alphabetical order

■ = YES □ = NO

	CalComp ColorMaster Plus 6613XF	Eastman Kodak ColorEase PS Printer	HP DeskJet 1200C/PS	HP PaintJet XL300 PostScript	QMS ColorScript 210
List price	\$8,995	\$7,999	\$2,399	\$3,995	\$4,995
Physical Characteristics					
Dimensions (HWD, in inches)	17.3 x 21 x 25.1	11.8 x 16.3 x 21	11.1 x 19 x 16.8	10.5 x 30 x 21	16.1 x 25.6 x 9.6
Weight (pounds)	62	60	29	45	49
Engine type	Thermal wax transfer	Thermal dye transfer	Ink jet	Ink jet	Thermal wax transfer
Engine model	CalComp 6613XF	Kodak ColorEase	HP DeskJet 1200C	HP PaintJet XL300	Mitsubishi 3710
Maximum resolution (dpi)	300 x 300	300 x 300	300 x 300 (graphics), 600 x 300 (text)	300 x 300	300 x 300
Controller	CalComp 6613XF	Sun SPARC workstation	HP DeskJet 1200C	HP PaintJet XL300	QMS Crown
RISC processor	33-MHz Intel 80960CA	40-MHz Sun SPARC	11-MHz Intel 80960SA	10-MHz Intel 80960	25-MHz Intel 80960CA
Rated engine speed (minutes per page)	1	3.5	1 (fast mode), 2 (standard mode)	1.5 to 6 (letter-size), 3 to 10 (tabloid-size)	1
Standard, maximum RAM	16MB, 64MB	16MB, 16MB*	4MB, 20MB	6MB, 18MB	8MB, 32MB
Accepts standard SIMMs	■	□	■	■	■
Interfaces					
Parallel/serial port	■ ■	■ ■	■ □	■ ■	■ ■
LocalTalk port	□	■	■	■	□
SCSI port for hard disk	■	■	□	□	Optional
Ethernet/Token-Ring interface available	■ □	■ □	■ ■	■ ■	■ □
Protocols supported by network interfaces	NetWare, EtherTalk, Novell IPX, TCP/IP	EtherTalk	EtherTalk, HP-IB, NetWare, TCP/IP	EtherTalk, HP-IB, NetWare, TCP/IP	DEC NET, EtherTalk, NetWare, TCP/IP
Automatic interface switching	■	■	■	■	■
Simultaneously active ports	■	■	■	■	■
Paper Handling					
Accepts plain paper	■	□	■	■	■
Printable area (inches) on letter-size paper	8.1 x 10.6	8 x 8.9	8.2 x 10.7	8.2 x 10.7	8.1 x 9
Printable area (inches) on legal-size paper	N/A	N/A	8.2 x 13.7	8.2 x 13.7	8.1 x 12
Printable area (inches) on B-size paper	11.3 x 17.3	N/A	N/A	10.7 x 16.7	N/A
Fonts and Features					
Printer-specific Windows 3.1 driver available	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)
Number of Type 1 fonts provided	35	35	35	35	35
Pantone-certified	■	□	■	■	■
Color separations	■	□	□	□	■
Automatic emulation switching	■	□	■	■	■
Customer Support					
Toll-free technical support	■	■	□	□	□
Telephone support hours (eastern time)	9:00–5:00 M–F	8:00–8:00 M–F	9:00–8:00 M, T, Th, F; 9:00–6:00 W	9:00–8:00 M, T, Th, F; 9:00–6:00 W	9:00–6:00 M–F
BBS	■	□	□	□	■
Warranty	1 year	1 year	1 year	1 year	1 year

N/A—Not applicable. The product does not have this feature

* An additional 70MB on a 120MB internal hard disk is dedicated to virtual memory

PC MAGAZINE PC MAGAZINE PC MAGAZINE
EDITORS' CHOICE EDITORS' CHOICE EDITORS' CHOICE

QMS ColorScript 230	Seiko Instruments Professional ColorPoint PSH	Tektronix Phaser 200e	Tektronix Phaser 200i	Tektronix Phaser IIsdx
\$7,995	\$9,999	\$3,695	\$5,995	\$9,995

20.5 x 26.5 x 13.2	19.3 x 15.5 x 27.4	11 x 13.5 x 17.5	11 x 13.5 x 17.5	14.3 x 17 x 27
102	44	40	40	73
Thermal wax transfer	Thermal dye transfer	Thermal wax transfer	Thermal wax transfer	Thermal dye transfer
Mitsubishi 6710	Seiko CH6104-PSH	Sharp TK4681	Sharp TK4681	Sharp TK4684
300 x 300	300 x 300	300 x 300	300 x 300	300 x 300
QMS Crown	Prime Option PSH	Tektronix 4681	Tektronix 4681	Tektronix 4684
25-MHz Intel 80960CA	25-MHz Weitek XL 8220	16-MHz AMD 29000	24-MHz AMD 29000	24-MHz AMD 29000
1	3 (three-pass ribbon) 4 (four-pass ribbon)	0.5 (three-pass ribbon), 1.3 (three-pass ribbon with plain-paper coat)	0.5 (three-pass ribbon), 1.3 (three-pass ribbon with plain-paper coat)	3.1 (three-pass ribbon), 4.1 (four-pass ribbon)
13MB, 32MB	16MB, 64MB	4MB, 8MB	6MB, 14MB	16MB, 64MB
☒	☒	☐	☐	☐

☒	☒	☒	☒	☒
☐	☒	☒	☒	☒
Optional	☒	☐	☒	☒
☒	☒	☒	☒	☒
DEC NET, EtherTalk, NetWare, TCP/IP	DEC LAT, EtherTalk, NetWare, TCP/IP	EtherTalk, TCP/IP	EtherTalk, TCP/IP	EtherTalk, TCP/IP
☒	☒	☒	☒	☒
☒	☒	☒	☒	☒

☐	☐	☒	☒	☐
8.2 x 10.1	8.1 x 8.6	8.1 x 10	8.1 x 10	8.1 x 8.6
8.2 x 13.1	8.1 x 10.6	N/A	N/A	8.1 x 10.8
10.7 x 16.1	N/A	N/A	N/A	N/A

☒ (included)	☒ (included)	☒ (included)	☒ (included)	☒ (included)
35	35	17	35	35
☒	☐	☒	☒	☒
☒	☒	☒	☒	☒
☒	☐	☐	☐	☐

☐	☒	☒	☒	☒
9 00-6 00 M-F	10 00-8 00 M-F	9 00-8 00 M-F	9 00-8 00 M-F	9 00-8 00 M-F
☒	☒	☒	☒	☒
1 year	1 year	1 year (\$475)	1 year (\$475)	1 year (\$475)

while business graphics show vibrant, saturated colors and sharp resolution.

The Phaser IIsdx is a speed demon among thermal dye transfer printers. Its Sharp TK4684 engine is rated at 3.1 minutes per page with a three-color ribbon—a spec confirmed by our test results. The standard 16MB of RAM is expandable to 64MB, and 39 PostScript fonts are built-in.

The Phaser IIsdx's paper tray handles 50 sheets of letter-, A4-, or legal-size media. Cost per image ranges from \$2.25 for letter-size paper with a three-color ribbon to \$3.75 for transparencies with a four-color ribbon—expensive but worth it.□

Tektronix Inc., Graphics Printing & Imaging Division, P.O. Box 1000 M/S 63-583, Wilsonville, OR 97070; 800-835-6100, 503-682-7377; fax, 503-685-3063.

EDITORS' CHOICE ► Tektronix Phaser 200e List price: \$3,695; 4MB RAM upgrade (adds 22 fonts), \$495; 22 additional fonts, \$595; additional 100-page- or 50-transparency- letter/legal paper tray or A4/A4 special-size paper tray, \$100; bottom feeder with second tray, \$500; one-color ribbon, \$132; three-color ribbon, \$165; three-color ribbon with coating for standard paper, \$126; network interfaces: Ethernet TCP/IP, \$1,495; EtherTalk, \$695; paper: 1,000 coated letter- or A4-size sheets, \$80; transparencies: 50 letter- or A4-size sheets, \$56. Emulations: Adobe PostScript Level 2, HPGL.

Circle 467 on reader service card

EDITORS' CHOICE ► Tektronix Phaser 200i List price: \$5,995; 4MB RAM upgrade, \$495; additional paper trays, ribbons, network interfaces, media: same as for Phaser 200e. Emulations: Adobe PostScript Level 2, HPGL.

Circle 468 on reader service card

EDITORS' CHOICE ► Tektronix Phaser IIsdx List price: \$9,995; 4MB RAM upgrade, \$495; 16MB RAM upgrade, \$1,995; 32MB RAM upgrade, \$3,990; additional 50-page- or 50-transparency- letter/A4/legal- or A4/A4 special-size paper tray, \$100; one-color ribbon, \$200; three-color ribbon, \$175; four-color ribbon, \$225; network interfaces: same as for Phaser 200e; paper: 200 coated letter- or A4-size sheets, \$100; 200 coated legal-size sheets, \$200; transparencies: 50 letter-, legal-, or A4-size sheets, \$75. Emulations: Adobe PostScript Level 2, HPGL.

Circle 469 on reader service card

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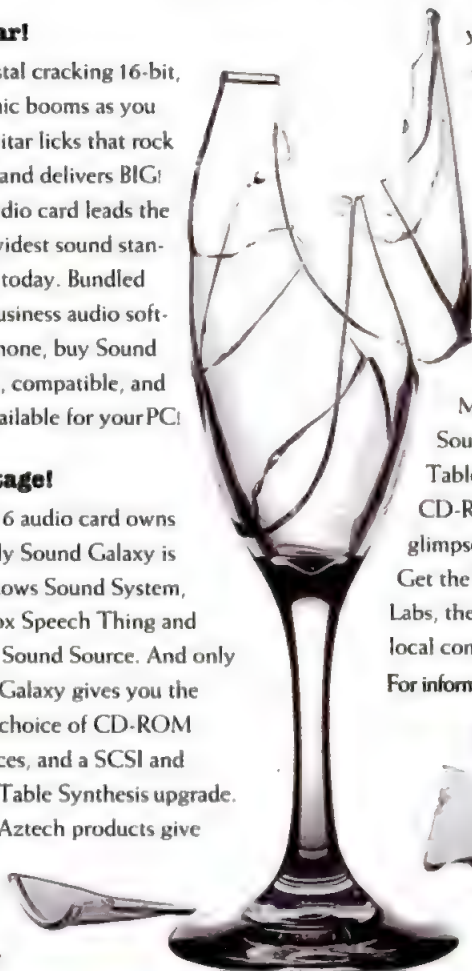
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COMPATIBLE WITH:			
SOUND BLASTER	YES	YES	YES
SOUND BLASTER PRO	YES	NO	NO
MICROSOFT WINDOWS SOUND SYSTEM	YES	NO	NO
COVOX SPEECH THING	YES	NO	NO
DISNEY SOUND SOURCE	YES	YES	YES
ADLIB	YES	YES	YES
MULTIPLE CD-ROM INTERFACES (AT-BUS)			
PANASONIC	YES	YES	NO
MITSUBISHI	YES	NO	NO
SONY* (adapter required)	YES	NO	NO
CD-ROM INTERFACE (SCSI)	OPTION TO UPGRADE!	NO	YES
OPTION FOR UPGRADE TO 16-BIT WAVE-TABLE SYNTHESIS	YES	YES	NO

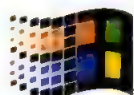


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CIRCLE 318 ON READER SERVICE CARD



Ink Jets *Expanding Their Niches*

Whisper-quiet operation, increasingly smear-free output, and prices comfortably below low-tier lasers have helped make ink jets the fastest-growing segment of the printer market. We review six ink jets under \$1,000.

Like the youngest child in the family, ink jet printers have struggled to develop a unique identity in the shadow of their older siblings: dot matrix and laser printers. The niche they've found is among home-office and small-business users who demand better quality than dot matrix offers but lower prices than lasers command.

The six ink jet printers we reviewed here have list prices from \$349 to \$719 and street prices in some cases under \$300. This puts them in a price category similar to dot matrix printers, and indeed ink jets are beginning to take over the portion of the personal printer market that was

once the realm of dot matrix. BIS Strategic Decisions predicts that dot matrix printers, projected to sell 5.2 million units in 1993, will sell only 1.2 million in 1997, while ink jet sales will rise from 2.1 million in 1993 to 5.4 million units sold in 1997.

Prices among personal laser printers rated at 4 to 6 pages per minute are also falling, with street prices as low as \$500. But according to BIS Strategic Decisions, ink jet technology has more room for price decreases than laser technology does. And many ink jets offer one advantage that lasers don't: color. By 1997, 3.8 million ink jets sold are expected to be color-capable printers.

Last year, we looked at four color

by Lori Grunin

ink jets priced from \$779 to \$3,495; among the most promising was the HP DeskJet 550C (now \$719), an Editors' Choice winner that's back for testing this year. Hewlett-Packard has also introduced some high-end color ink jet products, including the HP DeskJet 1200C and HP DeskJet 1200C/PS, and HP PaintJet XL300 PostScript. Because these printers can be used for intensive color output and are priced from \$1,699 to \$3,995—well above the other ink jets reviewed in this section and comparable with low-end thermal wax transfer models—we cover them in the color printers section instead.

Ink jet printers handle transparencies with aplomb, so they're great for putting together the occasional presentation. And they provide an economical solution for printing on oversize stock: B-size laser printers generally cost upward of \$3,000, while the tabloid-size Canon Bubble Jet Printer BJ-230 reviewed here has a list price of only \$549. Ink jets are compact and quiet, too—ideal traits for a portable printer or an unobtrusive desktop model.

SIGNS OF IMPROVEMENT

Despite their strong points, ink jets still remain at a disadvantage in certain areas,

but there are signs of improvement. For example, the consumables are quite expensive, which can be a problem in high-volume environments: The average for the printers we reviewed was 6 cents per page of text—well above the 3-cents-per-page cost of laser printers and the less than 1-cent-per-page cost of most dot matrix printers. However, the TI

microMarc manages a consumables cost of only 3 cents per page. And the HP DeskJet 1200C/PS boasts 2 cents per page of monochrome text.

Despite their better-than-dot-matrix quality, most

forces it through a nozzle, the Epson Stylus 800's Multi-Layer ACTuator Head (MACH) printhead charges a piezoelectric cell that contains a drop of ink within its cavity; when charged, the cell changes shape and releases the drop.

Since this technique doesn't rely on changes in temperature and pressure, the result, according to Epson America, is crisper characters—which is exactly what we found during our testing. The combination of the MACH technology with 360- by 360-dot-per-inch resolution results in extremely high-quality text output in the Stylus 800's standard print mode. (Because it uses fewer nozzles than the other units do, though, the characters produced in economy mode still look too much like dot matrix output.)

The other exceptions, the HP DeskJet 1200C and 1200C/PS, both reviewed in the color printers section, boast resolution enhancement that produces 600- by 300-dpi type that is hard to distinguish from that of a laser. That quality, together with a 6-page-per-minute text printing speed and a slot for a network interface card, may be a sign of things to come in ink jets, and a potential future threat to the low-end laser market.

PERFORMANCE TESTS

We subjected these products to our usual battery of printer tests, which include Windows applications (CorelDRAW, Lotus 1-2-3 for Windows, and Word for Windows). The printers run our Text Speed and Graphics Speed tests in different-quality modes; we found that performance in draft mode varied considerably among models, from a low of 46 characters per second (the Brother HJ-400) to a high of 94 cps (the Canon Bubble Jet Printer BJ-200 and Canon Bubble Jet BJ-230 in high-speed draft mode). Letter-quality speeds were more consistent, with every model except the Brother HJ-400 (46 cps) posting scores between 70 and 83 cps.

On our Graphics Speed test, the Epson Stylus 800 led with an impressive score of 2.6 graphics pages per minute, although at the expense of the outstanding quality it demonstrated when printing text. On our Windows application tests, the Canon BJ-230 and TI microMarc were generally the best performers.

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TI microMarc.....	291

ink jet output can't measure up to the clean, smudge-free type produced by laser printers. Typical characteristics of ink jet output include waviness in text, where successive passes of the printhead cause imperfect alignment; ink bleeding and smudging, and extra ink spray (called *satellites*) outside the character form. On pages with dense graphics, oversaturation is sometimes a problem as well.

Three ink jet printers managed to defy the norm, however. The \$449 Epson Stylus 800 has a new technology that yielded higher-quality text output than any other comparably priced ink jets. Rather than heating ink until expansion

HIGHLIGHTS

Ink Jets

INK JET PRINTER sales are still small compared with dot matrix and laser printer sales. But the tide is slowly turning as street prices for ink jets drop below \$300 and output quality improves. Their compact size and quiet operation makes them especially appealing as personal printers.

LOWER CONSUMABLE COSTS are reducing the price of ink jet ownership. Average per-page costs for monochrome output are now only about 6 cents, compared with nearly 10 cents among last year's models.

EPSON'S "MACH" TECHNOLOGY, implemented in the Epson Stylus 800, produced the best text output we've seen from an ink jet printer. Characters were crisply formed, with no apparent ink spray; the output was virtually indistinguishable from a laser printer's.

CANON'S BJ-230 offers 11- by 17-inch output at a street price of around \$400—far less than laser-printer alternatives. The BJ-200 and BJ-230 had the best quality graphics output of the ink jets.

- *General-purpose:* **Canon Bubble Jet Printer BJ-200**
- *Tabloid-size:* **Canon Bubble Jet Printer BJ-230**

Virtually all of the six ink jet printers reviewed here distinguish themselves in one way or another—high speeds, low prices and operating costs, superb print quality, or color capability. The \$349 Canon Bubble Jet Printer BJ-200 offers the best combination of features

for general-purpose use, at an eminently reasonable price.

The BJ-200's 360- by 360-dpi bubble jet print technology generates excellent text and graphics output. There's no performance penalty associated with quality, either: The BJ-200 was the fastest ink jet printer on the majority of our tests. In quality mode, its 82-cps performance was speedier than all but a few expensive dot matrix printers.

Only the Epson Stylus 800 offers better text output quality than the BJ-200, but the Stylus 800's graphics are unexceptional and its performance only average. The BJ-200's well-designed paper handling and below-\$300 street price make it an excellent

choice for day-to-day production of correspondence, or monochrome presentations.

LOW-COST TABLOID OUTPUT

The Canon Bubble Jet Printer BJ-230 offers all the advantages of its BJ-200 sibling, plus one: the ability to print on stock up to 11 by 17 inches. At a list price of \$549 and street price around \$400, the BJ-230 is the least expensive route to high-quality, tabloid-size output, such as large spreadsheets. It's a superb choice for a personal printer, especially if you work with large spreadsheets routinely.

HONORABLE MENTION: EPSON, HP

Epson's MACH print technology, featured in the Stylus 800, produces clear,

crisp characters that truly rival laser-printed text. The Stylus 800 eliminates the ink spray effects that contribute to fuzziness and smooths out visible jaggies. At a \$449 list price (as low as \$320 on the street), the Stylus 800 is a worthwhile stand-in for a low-end laser printer, as long as extremely sharp graphics aren't critical.

Hewlett-Packard's \$719 HP DeskJet 550C, about \$600 on the street, is the only reviewed ink jet model that supports color. Its output quality is not exceptional, but the price is right if you need color on occasion. If color is involved in a significant portion of your output, consider instead the HP DeskJet 1200C/PS, an Editors' Choice (or 1200C if PostScript is not a requirement) among the color printers reviewed in this issue.

If you need portability, Eastman Kodak's Diconix 701 printer is a good choice. An Editors' Choice in "Portable Printers, Steppin' Out" (*PC Magazine*, August 1993), the \$479 Diconix weighs 6.8 pounds with battery and AC adapter, and measures 2.4 by 11.7 by 7.7 inches. Text speed results were the fastest of the portables reviewed; print quality was excellent.

One notable shortcoming we uncovered during testing: Manual paper feeds didn't include a sufficient guide edge, leading to improper paper feeding and poorly aligned output. The Brother HJ-400, TI microMarc, and Epson Stylus 800 all had problems in this regard; the Canon models and DeskJet 550C don't offer a manual feed at all, which means you must feed transparencies and envelopes through the sheet feeder.

REVIEW CRITERIA

In this roundup, we review all ink jet printers released in the past year that list for under \$1,000 and were available in time for our testing. We also included the 1992 Editors' Choice HP DeskJet 550C, for a total of six printers from five manufacturers (Brother International Corp., Canon Computer Systems, Epson America, Hewlett-Packard, and Texas Instruments).

We discuss the Canon NoteJet 486, a

7.7-pound combination notebook computer and ink jet printer, in the sidebar "Canon NoteJet 486." The Star Micronics SJ-144, discussed in the sidebar of the same title, is not an ink jet printer but a very low-cost color printer that has been targeted at a similar market.

A number of ink jet printers were not shipping in time for testing: Advanced Matrix Technology's \$1,995 AMT Intelli-Plot Ink Jet, the \$419 C-Tech ProWriter CJ 300, Lexmark International's \$349 IBM 4076IJ, NEC Technologies' \$299 Jetmate 1000, and the \$1,599 Pacific Data Products ProTracer II (which can print on paper up to 17 by 22 inches). As we went to press, HP had just announced its \$379 DeskJet 310 color portable ink jet printer, and Canon had announced its color BJC-600 model (\$849).

We also did not re-review the three portable ink jet printers we covered in our special portable-computing issues (August 1992 and 1993): Eastman Kodak's \$329

Kodak Diconix 180si and \$479 Kodak Diconix 701, as well as Lexmark's \$399 IBM 4070IJ.

Despite their small number, the ink jet printers we tested offer plenty of variety. In the reviews that follow, you'll discover which ones are the best choices for your particular needs.

Brother International Corp.

Brother Ink Jet Printer HJ-400

BY LORI GRUNIN

The \$419 Brother Ink Jet Printer HJ-400 is optimized for mixed-platform GUI-based environments: It ships with both Microsoft Windows 3.1 and Apple QuickDraw drivers, auto-switches between parallel and serial ports, and comes with nine TrueType fonts on-disk. Despite its obvious attractions—which include the smallest footprint in its class—its speed and output quality don't quite

Star Micronics SJ-144

by Patrick Honan

One area where ink jet printers have excelled in the past is low-cost, plain-paper color printing. But as the Star Micronics SJ-144 proves, ink jets aren't the only way to address that need. The SJ-144 uses a heat fusion technology that offers the pluses of ink jet technology but eliminates the smearing that ink jets sometimes produce. Targeted at home office and small-business users, it has a competitive price of \$599 and a street price of approximately \$500.

The 360-dot-per-inch SJ-144 fuses a polyester-resin dye to the paper, rather than applying ink that soaks into paper, as ink jet printers do. The result is clear, sharp text and graphics with no bleeding, although some striping from the printhead's motion was visible on graphics.

The SJ-144 uses color or monochrome ribbon cartridges much like those used in dot matrix printers. Replacing a cartridge takes only seconds; you just flip out the old ribbon and snap in a new one.

The per-page cost is 5 cents with a

monochrome ribbon—comparable with that of ink jet printers. Color pages cost \$1.87 apiece, according to Star Micronics America; that's significantly above the typical cost-per-page of color ink jet and thermal wax transfer printers, but still lower than thermal dye transfer units. Unlike ink jet printers, though, the SJ-144's cost per page remains constant, regardless of coverage.

The SJ-144's performance on text, graphics, and Microsoft Windows applications tests was lower than that of the six ink jet printers we tested for this section. Its scores were 46 characters per second in quality mode and 1.2 graphics pages per minute for monochrome graphics, and .27 graphics pages per minute when printing color output in the CorelDRAW Windows application tests.

The printer provides three paper-feed paths; the front and rear paths can handle thicker media, such as trans-

parencies or even iron-on transfer paper. A standard 30-sheet paper tray holds enough for typical use—especially since the ribbon cartridge must be changed every eight pages when printing in color, regardless of coverage. Eight bitmapped fonts are built into the SJ-144, and 15 True-

Type software fonts are on the bundled floppy disk.

If you print color images in relatively low volumes but demand high quality, the Star Micronics SJ-144

is worth a look. It gives you color printing with the crisp output of a laser printer and the low price of an ink jet printer. □

Star Micronics America Inc., 420 Lexington Ave., #2702, New York, NY 10170; 800-447-4700; fax, 212-661-5838.

Star Micronics SJ-144 List price: \$599; three monochrome ribbon cartridges, \$29.95; three color ribbons, \$44.95. Emulations: Epson LQ, IBM Proprinter, NEC Graphics. Circle 447 on reader service card



match those of the competition.

The HJ-400 uses the same ink cartridges as the Canon Bubble Jet Printer BJ-200 and Canon Bubble Jet Printer BJ-230 and has the same high, 8.9-cent cost per page. But the HJ-400 was the slowest ink jet printer on all of our tests, averaging only about half the speed of the Canons.

The HJ-400's text and graphics print quality tends to be fuzzy, with a bit too much ink spray. The output is cleaner in the ink-saving, economy mode. Brougham, Roman, and Sans Serif fonts are built-in.

Graphics quality was acceptable with AGM (Alternate Graphics Mode)

enabled in IBM Proprinter emulation and in unidirectional mode in all emulations. In the printer's bidirectional mode, vertical alignment was poor.

Printing from both DOS and Windows

was straightforward, and the HJ-400 handled most of its supported media, including transparencies, without problems. Since the printer offers only a guide line, manually feeding envelopes and paper is a bit tough. You must

feed envelopes one at a time, and the HJ-400's output ledge accommodates only a small stack of pages.

For mixed PC and Macintosh environ-

ments, the HJ-400 is a low-cost alternative to a shared laser printer.

Brother International Corp., 200 Cottontail Ln., Somerset, NJ 08875-6714; 908-356-8880; fax, 908-356-4085.

Brother Ink Jet Printer HJ-400 List price: \$419; black-ink cartridges, \$25 each. Emulations: Brother HJ, Epson LQ, IBM Personal Printer, IBM Proprinter. Circle 441 on reader service card



Canon Computer Systems Inc.

Canon Bubble Jet Printer BJ-200

Canon Bubble Jet Printer BJ-230

BY LORI GRUNIN

For typical home or office uses, the Canon Bubble Jet Printer BJ-200 offers fast printing, quality output, and easy

SOUNDS LIKE **THUNDER** RUNS LIKE **LIGHTNING**



September 1993
466VL MAGNUM



January 26, 1993
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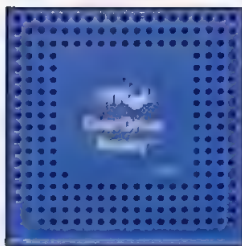
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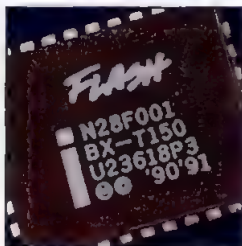
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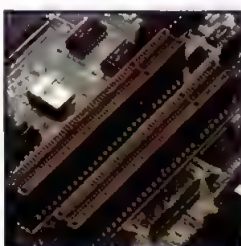
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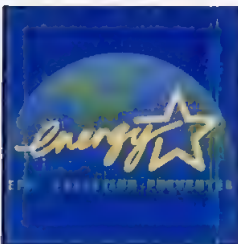
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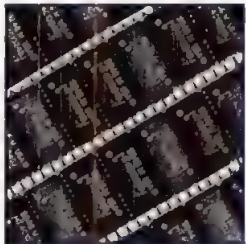
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Benchmark Tests: Ink Jets

Two Canon printers, the Canon Bubble Jet Printer BJ-200 and the Canon Bubble Jet Printer BJ-230, consistently turned in excellent scores. The Epson Stylus 800 proved fastest on our Graphics Speed test, while the TI microMarc performed solidly on our Windows application tests. The Brother Ink Jet Printer HJ-400 consistently showed the slowest performance.

The **Text Speed** test measures the printer's speed in producing one copy of a two-page business letter with 1-inch margins in 10-cpi type. We ran the test twice, once in draft mode and once in quality mode.

The **Graphics Speed** test measures the printer's speed in producing two copies of a complex single-page graphic containing a TIFF image, horizontal and vertical gray scales, and line art. A graphics print file was sent directly to the parallel port from DOS.

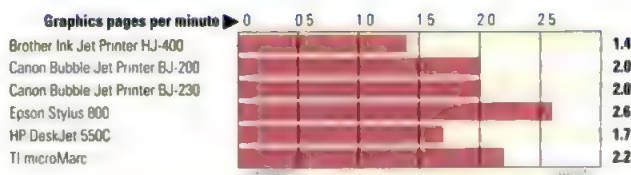
The **Word for Windows** test measures the printer's speed in producing a two-page report that uses multiple fonts and type styles. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **CorelDRAW** test measures the printer's speed in producing a single-

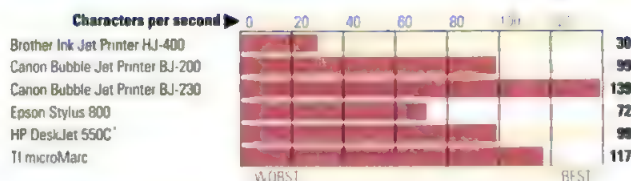
page CorelDRAW graphic that contains a TIFF image, horizontal and vertical gray scales, and line art. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **Lotus 1-2-3 for Windows** test measures the printer's speed in producing a complex two-page spreadsheet that contains pie, bar, and line charts. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

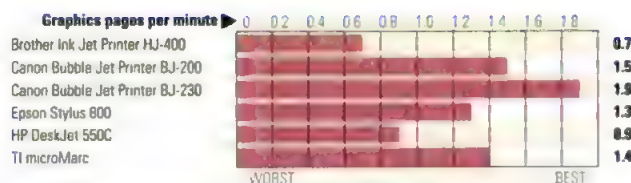
GRAPHICS SPEED



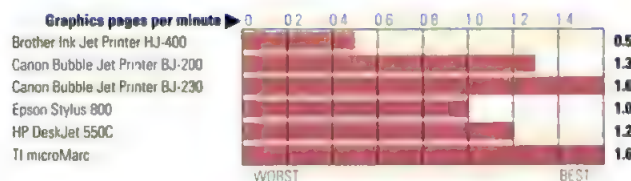
WORD FOR WINDOWS



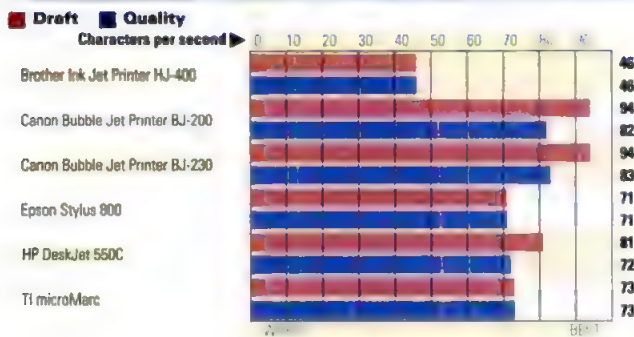
CORELDRAW



LOTUS 1-2-3 FOR WINDOWS



TEXT SPEED



operation—all for a reasonable price of \$349. If you require tabloid-size printouts, the nearly identical, \$549 Canon Bubble Jet Printer BJ-230 is an excellent value as well.

Canon's bubble jet technology results in extremely high-quality text, with excellent control over character formation in the default high-quality mode. Both printers also offer a super-high-quality mode,

which yields darker, marginally better output at about a 30 percent reduction in throughput, and a high-speed mode that produces quite usable output faster than any other product we tested. Seven internal fonts are provided with both models.

Graphics output isn't quite as crisp as text, but the quality is competitive with most ink jet printers. Ink doesn't adhere as well as it should to transparencies, but

the results are still acceptable.

Setting up both units is extremely simple; although you must use DIP switches to change emulations, the switches are easily accessible. The printers' elegant paper-handling system lets you feed envelopes and transparencies through the sheet feeder painlessly; a manual feed is not provided. Although the BJ-200 supports legal-size paper, the output tray isn't

► SUMMARY OF FEATURES

Ink Jet Printers

Products listed in alphabetical order

■ = YES □ = NO

PC MAGAZINE PC MAGAZINE
EDITORS' CHOICE EDITORS' CHOICE

	Brother Ink Jet Printer HJ-400	Canon Bubble Jet Printer BJ-200	Canon Bubble Jet Printer BJ-230	Epson Stylus 800	HP DeskJet 550C	TI microMarc
List price	\$419	\$349	\$549	\$449	\$719	\$419

Physical Characteristics

Dimensions (HWD, in inches)	4.8 x 14.1 x 7.3	8 x 13.3 x 5.8	8 x 17 x 5.8	6.5 x 17 x 10.3	8.2 x 17.5 x 15.3	5.6 x 15.9 x 13
Weight (pounds)	13.7	6.6	6.6	10.6	14.5	12.1
Number of jets	64	64	64	48	50	128
Maximum resolution (dpi)	360 x 360	360 x 360	360 x 360	360 x 360	300 x 300	300 x 300
Color capability	□	□	□	□	■	□
Installed memory	32K	49K	42K	32K	80K	24K
Parallel/serial interface	■ ■	■ □	■ □	■ □	■ ■	■ □
Printer-specific Microsoft Windows 3.1 driver available	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)	■ (included)

Paper Handling

Maximum paper width supported (inches)	9.5	9.5	12	8.5	8.5	9
Rated maximum paper weight (pounds)	24	28	28	24	36	24
Can print on card stock/transparencies/envelopes	□ □ ■	■ ■ ■	■ ■ ■	□ ■ ■	□ ■ ■	□ ■ ■
Pressure/tractor paper feed	■ □	■ □	■ □	■ □	■ □	■ □
Paper paths	Front L, rear U	Front L	Front L	Rear L, front U	Front U	Front L, rear U
Landscape printing	■	■	■	■	■	■

Typefaces

Courier	□	■	■	■	■	■
Gothic	□	□	□	□	■	■
Orator/Orator S	□ □	■ ■	■ ■	□ □	□ □	□ □
Prestige Elite	□	■	■	■	□	□
Sans Serif/Univers	■ □	■ □	■ □	■ □	□ ■	□ □
Script	□	■	■	■	□	□
Times Roman/CG Times	□ □	□ □	□ □	□ □	□ ■	□ □
Includes scalable fonts	□	□	□	■	■	□

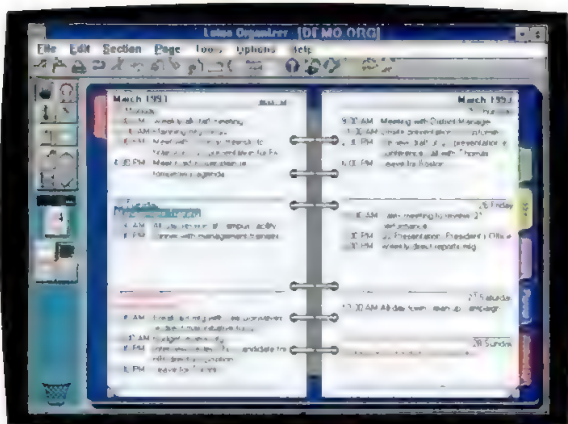
Control Panel

Buttons:						
Emulations	■	□	□	■	N/A	N/A
Form-feed and line-feed	■	■	■	■	■	■
Print mode	■	■	■	■	■	■
Typeface selection	■	□	□	■	■	■
"Ink cartridge low" indicator	□	□	□	■	□	□

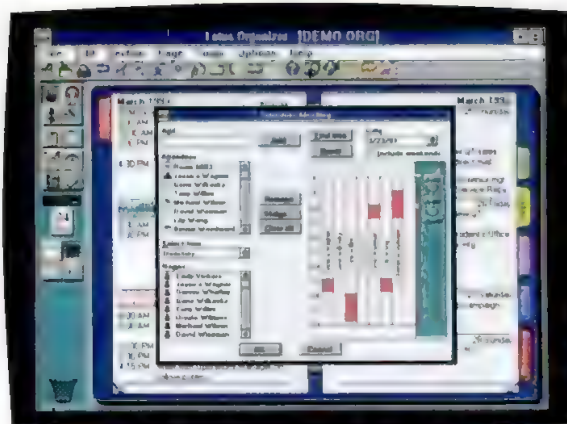
Customer Support

Toll-free technical support	■	■	■	■	□	■
Telephone support hours (eastern time)	9:15-7:00 M-F	9:00-8:00 M-F	9:00-8:00 M-F	9:00-9:00 M-F	9:00-8:00 M-F	6:00-6:00 M-F
BBS	■	■	■	■	■	■
Warranty	2 years	2 years (parts only)	2 years (parts only)	2 years	3 years	1 year

N/A—Not applicable. This printer has only one emulation.

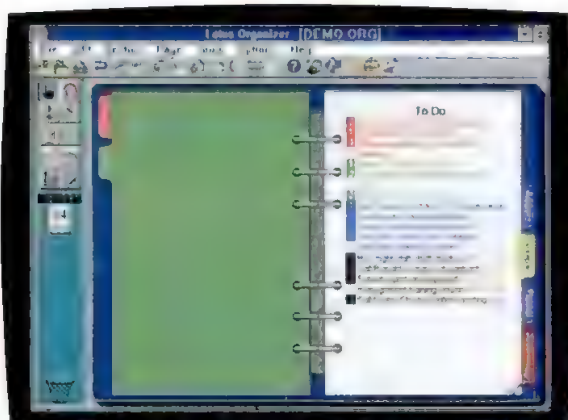


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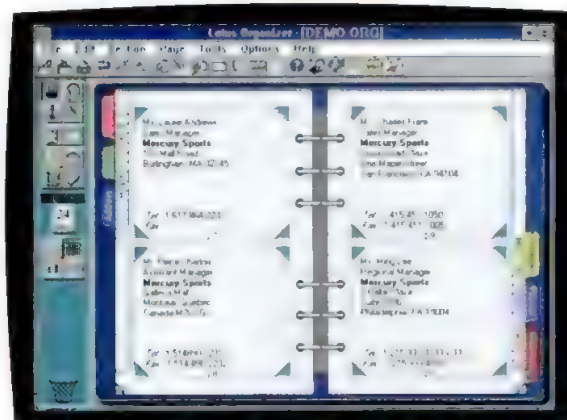


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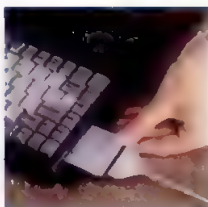
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425TX Notebook

64 Grayscale Monochrome Display, 9.5" usable diagonally
25MHz, 486SX Intel Processor
5.7 pounds including battery
3.5" Internal Floppy
PCMCIA Slot, Type II
More than 3 hours of battery life*
9600 Baud Fax/2400 Baud
Modem; Free Fax/Modem
Software

120MB IDE Hard Drive
4MB RAM, expandable to 20MB
Built-in Mouse Trackball
Serial, Parallel, Keyboard and
Printer Ports
External VGA Video Port for
simultaneous display
Free MS DOS 6.2, Windows for
Workgroups 3.11, Close-Up
4.0, A/C Adapter and Carrying
Case

\$1,895

Lease for only \$69/mo.



425TXT Notebook

Active Matrix LCD Display,
9.5" usable diagonally
25MHz, 486SX Intel Processor
6.1 pounds including battery
3.5" Internal Floppy
PCMCIA Slot, Type II
More than 2 hours of battery life*
9600 Baud Fax/2400 Baud
Modem; Free Fax/Modem
Software

200MB IDE Hard Drive
4MB RAM, expandable to 20MB
Built-in Mouse Trackball
Serial, Parallel, Keyboard and
Printer Ports
External VGA Video Port for
simultaneous display
Free MS DOS 6.2, Windows for
Workgroups 3.11, Close-Up
4.0, A/C Adapter and Carrying
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C433S Low Profile

- 33MHz 486SX Intel Processor
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- 4MB RAM
- 212MB Hard Drive

- 3.5" Floppy Drive
- Local Bus IDE Interface
- Local Bus ATI Video, 1MB RAM
- 14" Color Ultra VGA non-interlaced
- 5 16-bit ISA Slots

- 4 Drive Bays
- 101-Key Keyboard
- Free MS DOS 6.2, Windows for Workgroups 3.11, Close-Up 4.0, CompuServe Starter Kit & Mouse

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C450D Low Profile

- 50MHz 486DX2 Intel Processor
- Upgradable with Pentium Technology
- 4MB RAM, 128K Cache
- 212MB IDE Hard Drive

- 3.5" Floppy Drive
- Local Bus IDE Interface
- Local Bus ATI Video, 1MB RAM
- 14" Color Ultra VGA non-interlaced

- 5 16-bit ISA Slots
- 4 Drive Bays
- 101-Key Keyboard
- Free MS DOS 6.2, Windows for Workgroups 3.11, Close-Up 4.0, CompuServe Starter Kit & Mouse

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C468D Low Profile

- 66MHz 486DX2 Intel Processor
- Upgradable with Pentium Technology
- 4MB RAM, 128K Cache
- 212MB IDE Hard Drive

- 3.5" Floppy Drive
- Local Bus IDE Interface
- Local Bus ATI Video, 1MB RAM
- 14" Color Ultra VGA non-interlaced

- 5 16-bit ISA Slots
- 4 Drive Bays
- 101-Key Keyboard
- Free MS DOS 6.2, Windows for Workgroups 3.11, Close-Up 4.0, CompuServe Starter Kit & Mouse

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C450D Mini-Tower

- 50MHz 486DX2 Intel Processor
- Upgradable with Pentium Technology (ZIF)
- 4MB RAM, 128K Cache
- 212MB IDE Hard Drive
- 3.5" Floppy Drive

- CD ROM Drive
- Local Bus IDE Interface
- VLB Video Accelerator, 1MB VRAM
- 15" Flatscreen Color non-interlaced
- 8 16-Bit ISA Slots, 2 w/32-Bit VLB

- EISA Upgrade Available
- 7 Drive Bays
- 101-Key Keyboard
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- Free MS DOS 6.2, Windows for Workgroups 3.11, Close-Up 4.0, CompuServe Starter Kit & Mouse

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- Upgradable with Pentium Technology (ZIF)
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- Local Bus IDE Interface
- VLB Video Accelerator, 1MB VRAM
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- 8 16-Bit ISA Slots, 2 w/32-Bit VLB

- EISA Upgrade Available
- 7 Drive Bays
- 101-Key Keyboard
- Desktop option, Tower upgrade
- Free MS DOS 6.2, Windows for Workgroups 3.11, Close-Up 4.0, CompuServe Starter Kit & Mouse

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- 66MHz 486DX2 Intel Processor
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- 3.5" Floppy Drive

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- 32-Bit EISA SCSI & Local Bus IDE
- VLB Video Accelerator, 1MB VRAM
- 15" Flatscreen Color non-interlaced

- 8 32-Bit EISA Slots, 2 w/32-Bit VLB
- 7 Drive Bays
- 101-Key Keyboard
- Desktop option, Tower upgrade
- Free Windows NT, Close-Up 4.0, Netware Lite & Mouse

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C466De Tower

- 66MHz 486DX2 Intel Processor
- Upgradable with Pentium Technology (ZIF)
- 4MB RAM, 256K cache
- 525MB SCSI IDE Hard Drive
- 3.5" floppy drive
- 2X CD ROM Drive, SCSI
- 32-Bit EISA SCSI-2 & Local Bus
- 14" non-interlaced 72Hz HVRGA

- VLB Video Accelerator 1MB video memory (upgradable to 2MB) for 1024x768 with 256 colors
- True color capability (16.7 million colors)
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- 4 External, 5 Internal Drive Bays
- Two buffered serial ports, one extended parallel port, SCSI port
- Chassis: 23.8" high, 7.5" wide, 21.2" deep

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- Cable cover on back of chassis
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- 300 Watt power supply
- 101-Key Keyboard
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433TXC Notebook

- Dual-Scan Passive Matrix LCD Display (backlit, 640x480 resolution for 256 colors)
- 33MHz 486DX Intel Processor
- Display: 9.5" usable diagonally
- 6.5 pounds including battery
- 3.5" Internal Floppy

- PCMCIA Slot, Type II
- More than 2 hours of battery life (depending on applications, individual use and power management)
- 9600 Baud Fax/2400 Baud Modem; Free Fax/Modem Software
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\$3,195

200MB HD
Lease for only \$111/mo.

425TX/425XT Notebooks

- 25MHz 486SX Intel Processor
- Display: 9.5" usable diagonally
- 3.5" Internal Floppy
- PCMCIA Slot, Type II
- 9600 Baud Fax/2400 Baud Modem; Free Fax/Modem Software

- 4MB RAM, expandable to 20MB
- Built-in Mouse Trackball
- Serial, Parallel, Keyboard and Printer Ports
- External VGA Video Port for simultaneous display
- Free MS DOS 6.2, Windows for Workgroups 3.11, Close-Up 4.0, A/C Adapter and Carrying Case

425TX Notebook

- 64 Grayscale Monochrome Display (edgetit, 30mm dot pitch)
- More than 3 hours of battery life (depending on applications, use and power management)
- 5.7 pounds including battery
- 120MB IDE Hard Drive

425TXT Notebook

- Active Matrix LCD Display (640x480 resolution for 256 colors)
- More than 2 hours of battery life (depending on applications, use and power management)
- 6.1 pounds including battery
- 200MB IDE Hard Drive

\$1,895

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quite long enough to collect it.

Since the BJ-230 has no page-width sensor, printing from applications (such as the DOS text editor) that don't format the page or add hard carriage returns results in improper text wrapping on letter-size paper. But the BJ-230 can shrink text output to two-thirds of normal size and offset it slightly from the edge of the page, all at the touch of a button—a real convenience when it comes to printing long lines. Although other ink jets offer a similar feature, none make it so easily accessible.

Per-page cost for letter-size paper is a high 8.9 cents. But low street prices—below \$300 for the BJ-200 and around \$400 for the BJ-230—make these printers hard values to beat.

Canon Computer Systems Inc., 2995 Redhill Ave., Costa Mesa, CA 92626; 800-848-4123; fax, 714-438-3099.

EDITORS' CHOICE ► Canon Bubble Jet Printer BJ-200 List price: \$349; black-ink cartridges, \$25 each. Emulations: Canon BJ, Epson LQ, IBM Proprinter.

EDITORS' CHOICE ► Canon Bubble Jet Printer BJ-230 List price: \$549; black-ink cartridges, \$25 each. Emulations: Canon BJ, Epson LQ, IBM Proprinter.

Circle 442 on reader service card

Epson America Inc.

Epson Stylus 800

BY LORI GRUNIN

Epson America's first foray into low-cost ink jet printing, the \$449 Epson Stylus 800, offers the closest approximation to laser quality text of any ink jet printer

we've seen to date.

The key is Epson's MACH (Multi-Layer ACTuator Head) technology, which results in exceptionally well-formed characters and no excess ink spray. MACH technology uses a piezoelectric effect to open individual nozzles and deposit ink

cleanly on the page, rather than heating the ink and forcing it to squirt out. (A thorough discussion of MACH technology is provided in the introduction to this story.) Graphics output benefited less from the technology; it had a somewhat coarse look and wasn't as impressive as the text printing.

The Stylus 800 was a below-average performer in most modes on our text speed test, but it outpaced the Canon Bubble Jet Printer BJ-200 and Canon Bubble Jet Printer BJ-230 in their super-high-quality mode, the closest match to the Epson in output quality. Performance in graphics and Microsoft Windows



applications tests was above average.

Setting up the Stylus 800 is simple; you use the control panel to set the configurations and select from the five internal bitmapped fonts. Paper handling is generally acceptable, especially the manual-feed envelope autoloader, which works surprisingly well. Aligning manually fed paper and envelopes is difficult, though, since the unit uses a guide indicator rather than a guide edge. As a result, paper invariably fed at an angle during our testing.

In addition, users who occasionally need to create legal-size output are out of

luck with the Stylus 800: It only supports letter- and A4-size media. Although Epson does not claim the Stylus 800 will print on transparencies with the current ink, the printer did produce extremely high-quality output on transparencies nonetheless.

The Stylus 800 produces output at a competitive 7.1-cent cost per page. For generating the highest-quality letters, envelopes, and transparencies at a reasonable speed and price (as low as \$320), the Stylus 800 is an excellent choice.

Epson America Inc., 20770 Madrona Ave., Torrance, CA 90503; 800-289-3776; fax, 310-782-5225.

Epson Stylus 800 List price: \$449; black-ink cartridges, \$19.95 each. Emulations: Epson ESC/P- and ESC/P2-compatible printers.

Circle 443 on reader service card

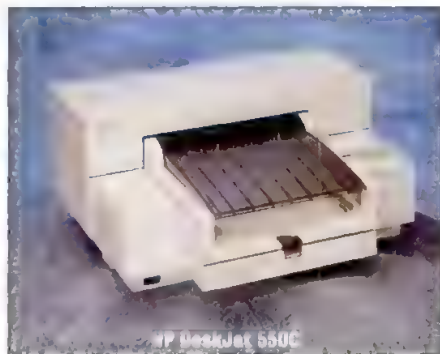
Hewlett-Packard Co.

HP DeskJet 550C

BY LORI GRUNIN

Hewlett-Packard hasn't changed the HP DeskJet 550C physically since we awarded it an Editors' Choice last year. But it has dropped the price to \$719—with a subsequent street price just under \$600—making this product a great choice for inexpensive color printing.

Ironically, the DeskJet 550C's main competition is its older sibling, the HP DeskJet 500C, which can be found for about \$200 less. But in addition to superior output, the DeskJet 550C provides more memory, fonts, and media support, and particularly stands out because it can print true black (not just process black) on the same page as color. The HP DeskJet 1200C/PS (reviewed in the color printers section) offers far faster perfor-



■ Canon NoteJet 486

by Lori Grunin

The Canon NoteJet 486, a 7.7-pound combination printer and notebook PC, lets you bring along the conveniences of the office when you're on the road. It is priced from \$2,499 to \$2,999 and is based on a 25-MHz TI 486SLC CPU. Tucked beneath the heart of the unit lies a 64-nozzle, 360-dot-per-inch bubble jet printer whose output rivals that of the Editors' Choice Canon Bubble Jet Printer BJ-200 and Canon Bubble Jet Printer BJ-230 we reviewed.

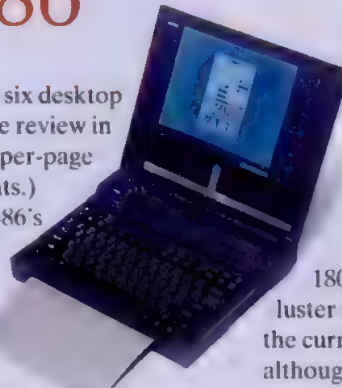
Effectively packing a printer into a notebook demanded a departure from ink jet printers' traditional all-in-one ink tank and printhead design, because typical ink cartridges are much too large to fit into the limited space of the NoteJet 486. The smaller cartridge that the NoteJet 486 uses can print only about 65 pages, compared with about 280 pages for the unit used by the desktop, BJ-200 printer. Since print-heads can produce approximately 3,000 pages, independent replacement of the printhead and ink tank keeps the consumables cost down and minimizes waste. Still, at \$8 per ink tank and \$43 per printhead—a consumables cost of 14 cents per page—the NoteJet 486 has high operating costs when it is compared with other monochrome ink

jet printers. (The six desktop ink jet printers we review in this section have per-page costs of 3 to 9 cents.)

The NoteJet 486's Express Bus—a data pathway analogous to a local bus—is designed to minimize the printer's demands on the CPU. As with consumables, this technique is of mixed effectiveness: At 30 characters per second for text and 0.9 graphics pages per minute, the NoteJet 486 was slower than all the desktop ink jets reviewed here and nearly all of the portable ink jet printers reviewed in our August 1993 issue.

One benefit of the NoteJet 486's integration is easy control over the printer configuration. You can set emulations and font selections with a Microsoft Windows utility. In theory, paper handling is just as elegant; you simply lift the keyboard and insert a stack of up to ten letter-size pages. In practice, though, the NoteJet 486 has a tendency to feed through the entire stack at once.

And how does the computing half of the NoteJet 486 measure up? In



addition to the 486SLC/25 processor, it comes with 4MB of RAM (expandable to 12MB), two PCMCIA Type II slots, and hard disk offerings from 85MB to 180MB. Its performance is lackluster when compared with that of the current crop of 486 notebooks, although the battery life was solid at 2 hours 30 minutes on our strenuous Battery Rundown test.

The NoteJet 486's street price (about \$2,400 to \$2,900, depending on the configuration) is a bit higher than many notebook/portable printer combinations—and its performance is not quite as good. But if printing is an essential part of your portable office, you'll certainly find it a convenience. □

Canon Computer Systems Inc., 2995 Redhill Ave., Costa Mesa, CA 92626; 800-848-4123; fax, 714-438-3099.

Canon NoteJet 486 List price: With 4MB RAM, 85MB hard disk, \$2,499; with 135MB hard disk, \$2,799; with 180MB hard disk, \$2,999. Numeric keypad, \$100; nickel hydride battery upgrade, \$270; palm rest, \$45; black-ink cartridges, \$8 each; extra printhead, \$43. Emulations: Canon BJ-130, Epson LQ, IBM Proprinter. Circle 446 on reader service card

mance, a higher resolution, and a PostScript option—but costs well over \$1,000.

You won't get blazingly fast output from the DeskJet 550C; it fell in the middle of the pack for monochrome output on our text, graphics, and Windows applications tests. Likewise, the quality of text printing is acceptable although not exceptional; characters are heavy and show some ink spray. A variety of font cartridges is available to supplement the four built-in fonts. The monochrome per-page cost is a reasonable 4 cents.

The DeskJet 550C generated its best monochrome graphics output when printing in color mode, with better detail than

the monochrome-only products in this section. The color output generally looked good, with smooth gradient fills. Some striping from the printhead movement was visible, however, as was a bit of color bleeding on both plain and coated paper. On transparencies, the output quality was excellent, with well saturated hues.

The DeskJet 550C has no manual-feed capability; it automatically feeds all media, including transparencies and envelopes. But the process is inconvenient: In order to load paper, you must first remove the output tray. The paper width adjustment is in an awkward spot, too.

If you don't need color output, you can get better output quality, faster performance, and lower prices from other printers. But if your printing ambitions extend beyond black and white, the DeskJet 550C is an inexpensive way to dazzle.

Hewlett-Packard Co., P.O. Box 58059, Santa Clara, CA 95051; 800-752-0900; fax, 208-344-4809.

HP DeskJet 550C List price: \$719; 256K memory upgrade, \$175; font cartridges, \$69 to \$140; high-capacity black-ink cartridges, \$31.95 each; regular-capacity black-ink cartridges, \$21.95 each; CMY cartridges, \$34.95 each. Emulations: HP DeskJet, HP PCL 3.

Circle 444 on reader service card

IBM



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Jay Pancost
IBM Customer Engineer



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L-R: Alice Robinson, Gregg McGhee, Jeff Herman and Beverly Whitman, Custom Build Technicians, IBM Personal Computer Company



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ValuePoint SpaceSaver

- Compact size: 14.2" W x 4.8" H x 16.5" D
- 3 slots (includes 1 VESA Local Bus slot) and 3 bays
- Also available in medialess (no drives) configuration to function as an economical LAN client workstation



425SX/S

ValuePoint Desktop

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- A super combination of speed, power, upgradability and expandability



433DX/D

ValuePoint Mini-Tower

- Convenient, compact Mini-Tower processor case measures 9.5" W x 16.8" H x 16.9" D
- Enormous room for growth: 8 slots (includes 1 VESA Local Bus slot), 6 bays
- Perfect format for high-powered computing (CAD/CAM, graphics, multimedia, etc.) or as a low-cost network server



466DX2/T

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- IBM HelpWare

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Processor	i486SX/25MHz	i486SX/25 MHz	i486SX/25 MHz	i486DX/33 MHz
Hard Drive/Memory	120MB/4MB	120MB/4MB	120MB/4MB	340MB/4MB
Drive(s)	3.5"	3.5"	3.5"	3.5"
Monitor	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI
Operating System	IBM DOS & WINDOWS™	IBM DOS & WINDOWS	IBM DOS & WINDOWS	IBM DOS & WINDOWS
Price* / IBM Credit Lease**	\$1,539 / \$56 per month	\$1,649 / \$60 per month	\$1,709 / \$62 per month	\$2,489 / \$90 per month
Features	425SX/Si	433SX/S	433DX/D	466DX2/T
Processor	i486SX/25 MHz	i486SX/33 MHz	i486DX/33 MHz	i486DX2/66 MHz
Hard Drive/Memory	212MB/4MB	120MB/4MB	120MB/4MB	527MB/4MB
Drive(s)	3.5"	3.5"	3.5"	3.5"
Monitor	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 15V 15" SVGA FS NI
Operating System	IBM DOS & WINDOWS	IBM DOS & WINDOWS	IBM DOS & WINDOWS	IBM DOS & WINDOWS
Price* / IBM Credit Lease**	\$1,699 / \$61 per month	\$1,789 / \$65 per month	\$2,059 / \$75 per month	\$3,399 / \$123 per month
Features	433DX/Si	433DX/S	466DX2/D	466DX2/T
Processor	i486DX/33 MHz	i486DX/33 MHz	i486DX2/66 MHz	i486DX2/66 MHz
Hard Drive/Memory	212MB/4MB	245MB/8MB	245MB/4MB	527MB/8MB
Drive(s)	3.5"	3.5"	3.5"	3.5"
Monitor	IBM 14V 14" SVGA NI	IBM 14V 14" SVGA NI	IBM 15V 15" SVGA FS NI	IBM 15V 15" SVGA FS NI
Operating System	IBM DOS & WINDOWS	OS/2®	IBM DOS & WINDOWS	OS/2
Price* / IBM Credit Lease**	\$2,049 / \$74 per month	\$2,359 / \$85 per month	\$2,729 / \$98 per month	\$3,589 / \$129 per month

ValuePoint Si systems do not include all features listed above chart. Please refer to product details listed at left, or call for more information. ValuePoint Si prices listed reflect IBM Basic Keyboard only. IBM Enhanced Keyboard available at additional cost.

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Graphics Speed: 1.4 gppm

WINDOWS APPLICATIONS:
Word for Windows: 8 cps
CorelDRAW: 0.7 gppm
Lotus 1-2-3 for Windows: 0.5 gppm



Brougham
Roman
Sans serif



Canon Bubble Jet Printer BJ-200

\$349

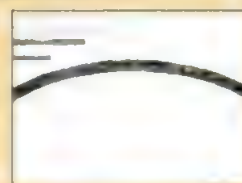
64-nozzle monochrome ink jet printer capable of letter-size printing

Draft Text Speed: 94 cps
Quality Text Speed: 82 cps
Graphics Speed: 2.0 gppm

WINDOWS APPLICATIONS:
Word for Windows: 8 cps
CorelDRAW: 1.4 gppm
Lotus 1-2-3 for Windows: 1.1 gppm



Courier Prestige
Draft Roman
ORATOR Sans serif
Orator-S Script



Canon Bubble Jet Printer BJ-230

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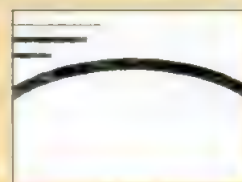
64-nozzle monochrome ink jet printer capable of 11- by 17-inch printing

Draft Text Speed: 94 cps
Quality Text Speed: 83 cps
Graphics Speed: 2.0 gppm

WINDOWS APPLICATIONS:
Word for Windows: 8 cps
CorelDRAW: 1.9 gppm
Lotus 1-2-3 for Windows: 1.6 gppm



Courier Prestige
Draft Roman
ORATOR Sans serif
Orator-S Script



Epson Stylus 800

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48-nozzle monochrome ink jet printer capable of letter-size printing

Draft Text Speed: 77 cps
Quality Text Speed: 77 cps
Graphics Speed: 2.6 gppm

WINDOWS APPLICATIONS:
Word for Windows: 12 cps
CorelDRAW: 1.4 gppm
Lotus 1-2-3 for Windows: 1.2 gppm



Courier Sans H
Prestige Sans serif
Roman Script
Roman T



HP DeskJet 550C

\$719

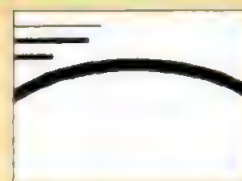
50-nozzle color ink jet printer capable of letter-size printing

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Quality Text Speed: 72 cps
Graphics Speed: 1.7 gppm

WINDOWS APPLICATIONS:
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CorelDRAW: 0.9 gppm
Lotus 1-2-3 for Windows: 1.2 gppm



Courier
CG Times
Letter Gothic
Univers



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Word for Windows: 117 cps
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Lotus 1-2-3 for Windows: 1.6 gppm



Courier
Letter Gothic
Dutch



Texas Instruments Inc.

TI microMarc

BY LORI GRUNIN

With a list price of only \$369 and an almost laser-like cost per page of just 3 cents, Texas Instruments' TI microMarc is the most cost-effective ink jet printer of the crop. It's also one of the fastest: Its performance was excellent on our Graphics Speed and Microsoft Windows applications tests, and was about average on our Text Speed test. But the trade-off is output that doesn't compare favorably with that of the other products, many of which sell for about the same price.

The TI microMarc's output falls short in two ways. Text has a slightly jagged appearance, a limitation of the printer's 300-dot-per-inch resolution. But the more obvious flaw stems from the same technology that gives the printer its speed—the 128-nozzle Xerox printhead, which prints two and a half lines on each pass. The TI microMarc sometimes mismatches the tops and bottoms of the half lines; the result is a wavy effect and occasional smearing. The TI microMarc's graphics output likewise suffers from slight vertical misalignment and wavy diagonal lines.

The print-quality problems are exacerbated on transparencies. In addition to slight jaggedness and misalignment, the output has horizontal striping from the motion of the printhead.

In all other respects, the TI microMarc is well-designed. Plug-and-play installation and control panel-based configuration make it easy to set the unit up, and its auto-fed paper handling worked flawlessly. Manually feeding envelopes and paper proved trickier, since the printer lacks an edge long enough for aligning the stock.

The TI microMarc provides Courier,

Dutch, and Letter Gothic internal fonts, and is the only reviewed ink jet printer other than the HP DeskJet 550C to support font cards (albeit proprietary ones that were not yet available as we went to press).

The TI microMarc's street price, in the low \$300s, and rock-bottom operating expenses make it the right choice if minimizing long-term costs is your primary goal. If output qual-

ity matters to you at all, though, one of the other ink jet printers reviewed in this section is probably a better choice. □

Texas Instruments Inc., P.O. Box 202230, Austin, TX 78720-2230; 800-527-3500.

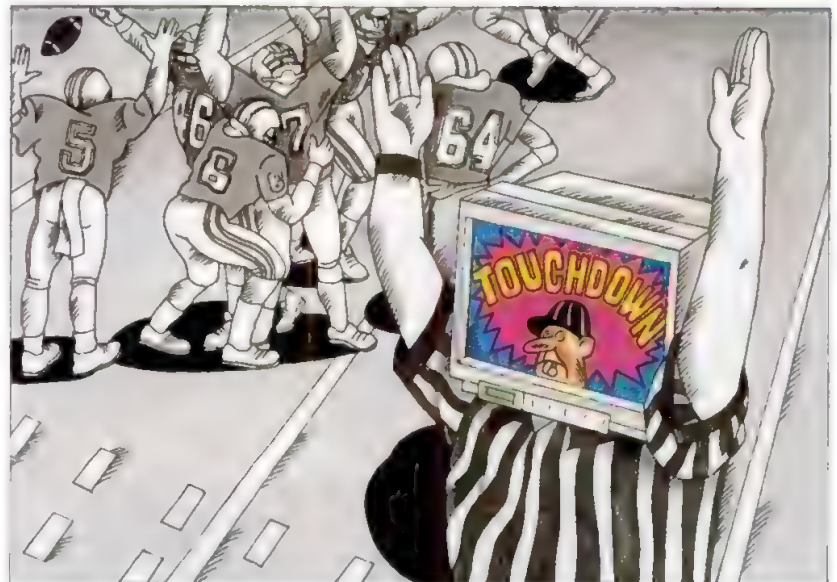
TI microMarc
List price: \$369;
black-ink cartridges, \$40 each.
Emulations: HP



DeskJet, HP PCL 3.

Circle 445 on reader service card

MONDO MONITOR®



As a change of pace from the office, Delmer began moonlighting as a referee much to the joy of football fans who found band signaling difficult to follow.

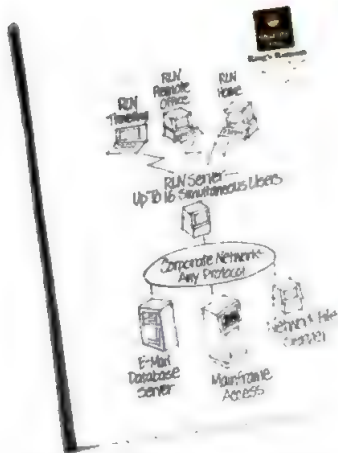
(The clear, brilliant image on the MAG MX17F monitor offered fans a unique perspective of the game.)

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WHEN REMOTE ACCESS PRODUCTS WERE TESTED IN THE ARIZONA DESERT, GUESS WHO HAD THE HOTTEST SOLUTION?

The test was part of a comprehensive analysis of remote network access solutions done by ZD Labs. They packed up nine dial-in server products and sent a technician out to do some real field testing—in the town of Sedona, Arizona, pop. 7940.

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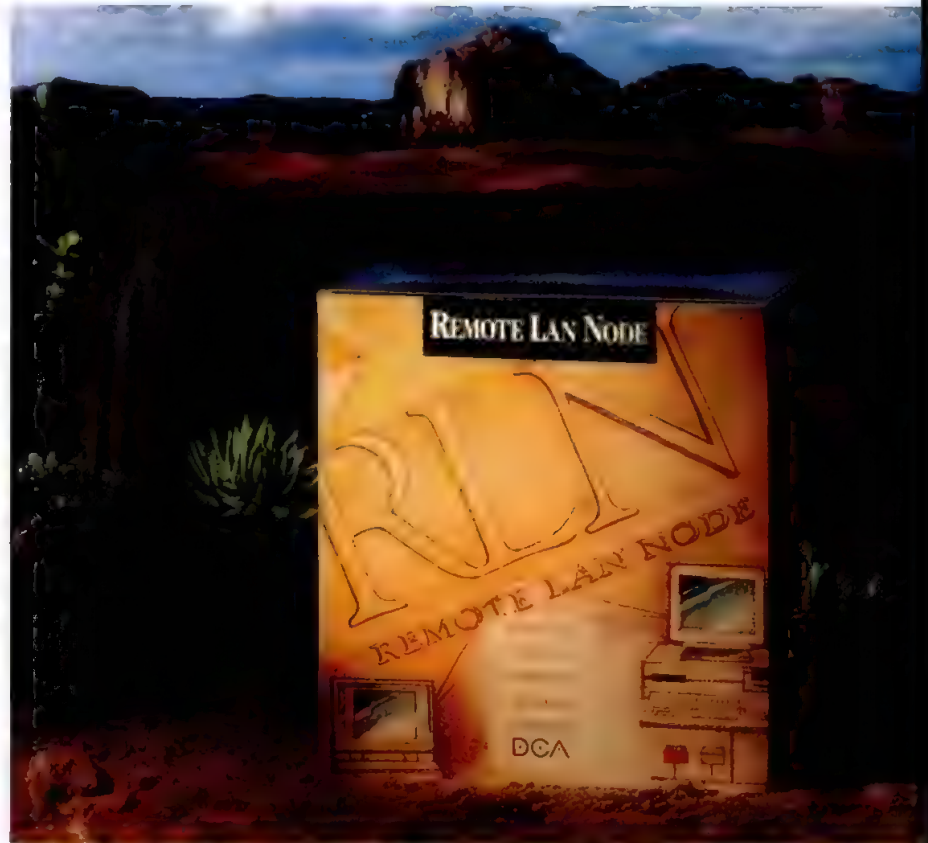


RLN PROVED IT COULD TAKE THE HEAT.

We'll let ZD Labs do the talking. "The best product was Remote LAN Node—a software solution that acts like a multiprotocol router when installed on a PC on a LAN."

The report went on to say, "Our winner, DCA's RLN, stood out for its capability to handle multiple communications protocols," commenting that "it won hands-down on flexibility, allowing our remote users to connect to both IPX and IP servers in the same call."

All in all, the report concluded, if you're looking for versatility, "None of the other units we tested came close."



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PC as a comm server for 16 concurrent users. And RLN offers three levels of configurable security, including the industry's first Remote Security Adapter.

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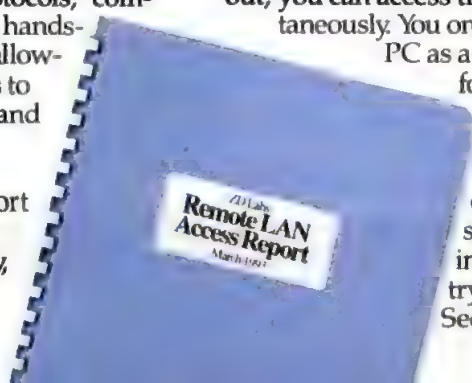
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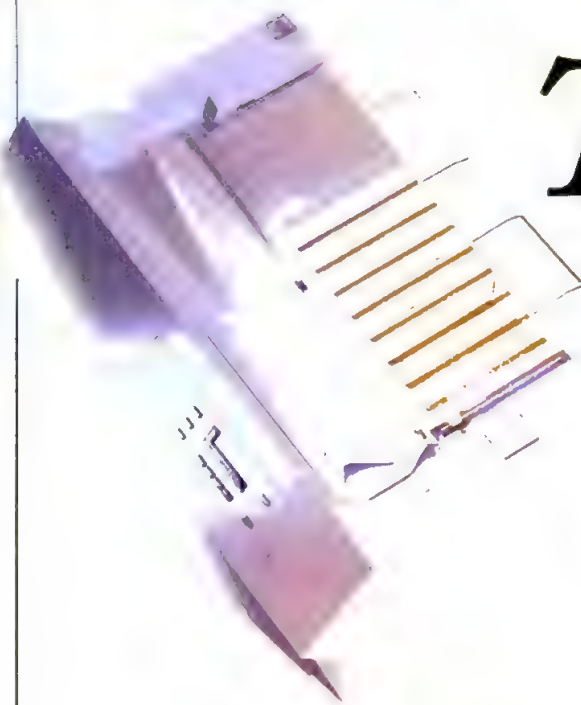
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CIRCLE 901 ON READER SERVICE CARD





Dot Matrix *Old Technology, New Choices*

Dot matrix is on the decline, but for high-volume text output, multipart forms printing, or rock-bottom prices, it's still the right choice. These 35 printers take advantage of impact technology's strengths.

Many people think of the dot matrix printer as a bargain-priced last resort for students or the home office, but that's hardly an accurate picture. Impact printers are a diverse group. The 35 models we tested this year range from the 9-pin Citizen GSX-190 (\$199) to the 132-hammer Mannesmann Tally MT691 line printer emulator (\$9,999). Clearly, there's a lot more to the dot matrix market than a losing battle against ink jets and inexpensive lasers.

Dot matrix printers still offer distinct advantages for certain uses. Some of the features that set dot matrix printers apart from

their competitors include:

- **Flexibility.** No other kind of printer can print on as many kinds of stock, including multipart forms. For wide-carriage output, a dot matrix printer is by far the most sensible and economical choice—B-size laser printers still carry list prices of \$4,000 or higher. And many dot matrix printers provide at least rudimentary color capabilities.
- **Speed.** For the money, there is no faster output technology.
- **Low cost.** Not only are list prices lower than they are for competing technologies, but per-page operating costs and ownership costs are lower as well. Dot matrix output typi-

by Oliver Rist

► IN THIS REVIEW

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cally costs under 1 cent per page, compared with an average of 6 cents for ink jets and 2 to 3 cents for laser printers.

• **Low maintenance.** More rugged than other types of printers, dot matrix units require less attention. Give a networked dot matrix printer a whole box of fanfold paper, and you may only have to visit it once a week instead of daily.

These advantages make dot matrix printers particularly useful for accounting departments that need quick, inexpensive wide-carriage output; small businesses that need high-quality (24-pin) text as well as multipart forms, labels, and occasional color; and anyone who does high-volume forms printing.

The one area where laser, ink jet, and dot matrix machines truly overlap is the desktop personal printer market. Since these types of printers produce primarily monochrome text and graphics, choosing among them is purely a matter of cost versus output quality.

The unique strengths of the dot matrix printer account for its sustained sales. BIS Strategic Decisions reports that 5.4 million dot matrix printers were sold by U.S.-based distributors last year. This compares with just over 5 million in 1991. Unexpected growth in international sales of U.S.-based distributors drove 1992 sales figures above early estimates.

But BIS figures show dot matrix sales have peaked in the face of competition from other technologies. Sales of 9-pin units in particular have suffered, falling

from 48 percent of all dot matrix sales in 1991 to 41 percent last year. Some manufacturers, including Toshiba, have discontinued new product development altogether. BIS estimates that by 1995, sales of dot matrix printers will be surpassed by ink jet sales, which totaled only 1.6 million units last year.

BUILDING ON STRENGTHS

A couple of years ago, dot matrix-printer manufacturers were packing more and more features into their printers—higher

output quality, more internal fonts, scalable fonts, and quiet modes—in an attempt to keep pace with emerging printer technologies. These features didn't achieve quite the desired effect, however. Scalable fonts (found in the reviewed products from Digital Equipment Corp., Epson America, Panasonic Communications & Systems Co., and Tandy/Radio Shack Corp.) have been largely obviated by Adobe Type Manager and TrueType fonts, which offer more flexibility and better results. Quiet modes (offered by more than half of the models in this roundup) succeed in reducing noise, but laser printers and ink jets are quieter still.

Today, impact printer manufacturers are more aware of limitations and are building printers to excel in markets their industry already dominates. Improved features that became popular this year are all old staples of the impact printer market. These include low-cost color options and multiple paper paths with easy paper parking, so you can switch among cut sheets, fanfold paper, multipart forms, and even envelopes. Built-in bar code capabilities in many business-oriented printers make mass mailings easier. And despite added features, front panels offer simpler configuration and more straightforward menus. Of course, additional fonts, faster performance, and lower

HIGHLIGHTS

Dot Matrix Printers

COMPETITION FROM ink jets and inexpensive lasers is pinching dot matrix in the personal-printer market. But with street prices under \$200, low-end impact printers are still less expensive.

24-PIN MODELS have overshadowed 9-pin models, even among printers destined for high-volume workhorse duty. Now the same printer you buy for high-speed draft output and multipart forms can print correspondence with flair.

DOT MATRIX PER-PAGE COSTS, at about 0.3 to 2.5 cents, remain comparatively lower; per-page costs are

about 6 cents for ink jets and 3 cents for laser printers.

COLOR IS AVAILABLE on 10 of these printers, either standard or as an under-\$70 option. Though full-color graphics output stretches the capabilities of dot matrix, spot color is sometimes impressive.

MANNESMANN TALLY CORP. means speed. The 24-pin Mannesmann Tally MT360 took first place among traditional printers in virtually all of our tests. The 132-hammer Mannesmann Tally MT691 line printer emulator turned out an amazing 1,049 lines per minute.

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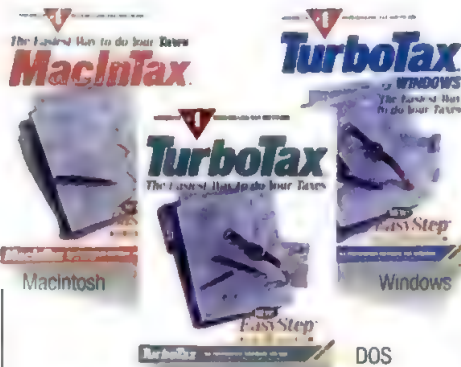
5 The Overlooked Deduction

You'd have to be a professional tax preparer to know all the deductions you're entitled to. If you miss just one, it could cost you hundreds of dollars.

6 The Exceeded Guideline

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prices are—and doubtless always will be—goals as well.

Over the next year, higher-end dot matrix printers should become more network-capable, with direct network connections and automatic interface switching and paper selection. The reviewed printers from Datasouth Computer Corp., Digital Equipment Corp., and Mannesmann Tally Corp. already include some or all of these capabilities.

As the dot matrix market becomes more focused, two clear segments are emerging. One is the price-sensitive market for personal printers—those machines actually sitting on a desktop and dedicated to a single user. Though ink jet printers are coming down in price, only dot matrix printers sell for less than \$200. Of the printers we review here, those from Citizen America Corp., Epson America, Lexmark International, and Tandy clearly belong in the personal printer category.

The other segment is high-volume applications, where dot matrix is solidly entrenched as the printer type of choice. Market dynamics here differ from those in the personal market. Printers often sell for \$1,000 or more; speed and paper-handling flexibility are critical, as is support for multipart forms. The reviewed printers from Advanced Matrix Technology, Datasouth, Mannesmann Tally, and Output Technology Corp. fall into this category.

In the rarefied stratosphere of extremely high-volume applications—those demanding more than 50,000 pages per month—even these workhorse printers are inadequate. If you need to produce that much output with a single printer, look at a line printer emulator such as the Output Technology EuroLine 800 (\$8,995) or Mannesmann Tally's MT691 (\$9,999).

Even in the workhorse market, 24-pin printers are displacing 9-pin models. The reason is simple enough: As long as price and speed are acceptable, why not output draft pages that are easier to read as well?



EDITORS' CHOICE

- *Personal Printer:* **Epson ActionPrinter 5000+**
- *General-Purpose Printer:* **Okidata Microline 590, Okidata Microline 591**
- *High-Volume Forms Printer:* **Mannesmann Tally MT360**

Impact printers may be pedestrian, but for some applications they still have an edge over ink jets and low-priced lasers. For personal use, dot matrix remains a particularly economical choice; though ink jets are closing the gap quickly, per-page operating costs for dot matrix units are

still lower. But if price is not your primary concern, weigh your requirements and options carefully; another technology may better suit your needs. For many high-volume applications, a dot matrix printer is the best choice as well. Only impact printers can handle multipart forms, and most high-end dot matrix products offer wide carriages and convenient paper-handling options that laser printers can't match for the price.

PERSONAL PERFORMER

Even if your budget is restricted, there's no reason to settle for 9-pin output when the Epson ActionPrinter 5000+ (\$349

list) sells for as little as \$235. The ActionPrinter 5000+, which is sold under the Epson LQ-570+ label in some channels, is an all-around winner for low-volume desktop use. It offers high-quality 24-pin output, superb paper handling, and a wide selection of features including ten internal bit-mapped fonts and four scalable fonts that can be sized from 8 to 32 points. The ActionPrinter 5000+ is fast, too. It consistently scored above average on our standard tests and performed admirably on our Windows applications tests—in many cases outpacing printers costing twice as much.

PERFORMANCE

We put the submitted printers through our Graphics Speed test and our Text Speed test in draft and quality modes to quantify

raw performance. We also ran our suite of Windows applications tests, which print typical business documents from popular Windows programs.

An impact printer's speed generally depends upon the speed at which the printer feeds paper and the

number of pins in the printhead (the fewer the faster). Thus, 9-pin printers are historically faster than 24-pin units. But this year, we saw a number of exceptions to this rule. The Mannesmann Tally MT360 (\$2,695),

for instance, exhibits all the characteristics of a high-end office workhorse—as well as the print quality and font versatility of a 24-pin unit. It was the fastest traditional printer in this roundup, followed by the Okidata Microline 395 (\$1,499) and Okidata Microline 395C (\$1,599).

Of the two line printer emulators, Mannesmann Tally's MT691 won handily, with a score of more than 1,000 lines per minute in wide-carriage draft mode. This impressive figure is a result of the MT691's stationary-hammer design, which prints a full line of dots at a time. The EuroLine 800 uses four printheads, which operate in parallel. It turned in a top speed of 611 lines per minute, which would have placed it at the top against any other competition.

Advanced Matrix Technology's AMT Accel-292d and AMT Accel-294d each fea-

An impact printer's speed depends upon two factors: the speed at which the printer feeds paper and the number of pins in the printhead.

HIGH-VOLUME WORKHORSE

At the other end of the spectrum is the \$2,695 Mannesmann Tally MT360 (about \$2,300 on the street), a heavy-duty machine that's overkill for desktop use but perfect for many high-volume applications. The 24-pin, wide-carriage MT360 topped every performance category but one (our Text Speed test in wide-carriage quality mode, where it fell a mere 5 characters per second short of the lead). At 237 cps printing draft text, 111 cps printing letter-quality text, and 3.6 graphics pages per minute printing graphics, the MT360 is faster than just about anything short of a \$5,000-plus line printer emulator.

The MT360 offers automatic port selection, nine internal letter-quality fonts, and bar code capabilities. Text output was crisp and clear despite the printer's speed, but we found that graphics tended to be heavily oversaturated.

Mannesmann Tally rates the MT360 for 22,500 pages per month. If that's more than you need, consider the \$2,295 Mannesmann Tally MT350 (about \$2,000 on the street). It offers an identical feature set but is rated for slightly slower operation and a maximum 18,000-page-per-month duty cycle.

GENERAL-PURPOSE WINNERS

If your printing demands fall somewhere between the ActionPrinter 5000+ and the MT360, consider the 24-pin Okidata Microline 590 and Okidata Microline 591. (Both are the same model in, respectively, narrow- and wide-carriage form.) Moderately priced at \$699 and \$949, they typically sell for around \$400 and \$500. Both were among the best performers on our tests, particularly excelling on our Windows applications tests.

The Okidata printers complement their performance with thoughtful design. Both feature OkiSmart Paper Handling, a feature that adjusts print-head position automatically to adapt to paper or forms of differing thicknesses. Three paper-feed paths—top, front, and bottom—are standard, and additional tractors and a cut-sheet feeder are available as options. Okidata also bundles a number of utilities, including its own OkiSmart Panel, which lets you configure the printer from a convenient software-control panel on your PC.

HONORABLE MENTION

The Mannesmann Tally MT691 line printer emulator wins an honorable mention for its adept handling of

extremely-high-volume jobs. With a 250,000-page-per-month rated duty cycle and 1,049-line-per-minute top speed, it's ideal for churning out reams of data. But the MT691's less-than-intuitive setup and \$9,999 list price (about \$8,000 street) make the MT360 a better choice for all but the most demanding applications.

NOTABLE 9-PIN

Once again, this year we didn't award an Editors' Choice to any 9-pin models. Even the least expensive unit that we tested, the \$199 Citizen GSX-190, sells for about \$165. With 24-pin printers offering better output quality, faster performance, and nearly comparable prices, the 9-pin market is headed toward extinction.

But one high-end 9-pin printer did pique our interest for special-purpose use: the \$2,195 Datasouth Documax A3302. Targeted at the same market as the MT360 (high-volume forms-printing applications), the easy-to-configure Documax A3302 can handle nine-part forms through either one of its two vertically oriented tractor feeders. But if that particular capability is one you can live without, you'll be better served by a 24-pin unit.

ture a dual-printhead design, but their performance in most cases was barely better than that of AMT's single-head counterparts. The slowest scores on most of our tests were consistently turned in by the Seikosha America and Tandy printers. The Seikosha SP-2450 had persistent trouble with paper jams as well.

Our early production version of Lexmark's IBM 2390 Plus actually burned out its print mechanism on our strenuous graphics tests and had to be replaced. The Tandy DMP 250 and the three members of Panasonic's KX-P3000 line also paused to cool off when their thermal sensors determined they were running too hot after printing pages of dense graphics.

REVIEW CRITERIA

We requested that vendors send us any 9-pin and 24-pin dot matrix printer or line

printer emulator introduced in the past year. This criteria netted 21 24-pin printers, 12 9-pin printers, and 2 line printer emulators from a total of 12 manufacturers. Nine of these printers are high-end forms-oriented models with list prices above \$1,000. Thirteen of the reviewed printers have wide carriages, and 10 support color, either standard or as an option.

Printers that didn't ship by our deadline include the CIE America CI-1000 SQ (\$8,895), the C.Itoh ProWriter C-410 (\$399), the C.Itoh ProWriter C-415 (\$499), the C.Itoh ProWriter C-420 (\$499), the C.Itoh ProWriter C-425 (\$599), the C.Itoh ProWriter C-610III (\$1,449), Lexmark's IBM 2381 Plus (\$549), Lexmark's IBM 2391 Plus (\$599), the Tandy DMP 205 (\$329.99), and the Tandy DMP 206 (\$249.99). The Panasonic KX-P1150 (\$169.95) arrived too late for testing. Idea

declined to send the Idea 13X20 (\$1,795). We didn't test the Epson LQ-570+ (\$349), which is identical to the Epson ActionPrinter 5000+ but sold through different channels. Nor did we test the Mannesmann Tally MT350 (\$2,295), a slightly slower and less expensive version of the MT360.

While there are differences in output quality among 9-pin and 24-pin printers, we don't believe they are as great as the difference between output generated by a typical 9-pin printer and a typical 24-pin model. So, in this section only, we are not printing output samples. If print quality is an issue, you may want to look at an ink jet or low-cost laser printer.

There are still plenty of choices in the dot matrix market. The information on the following pages should help you determine which dot matrix printer is right for you.

TRAPPED IN THE BODY OF THIS TINY SER

This is a story about a small computer engineered to be so dependable, you won't think twice about trusting it with your mission-critical applications. And to be this without filling a closet,



much less a room. If you haven't thought of Compaq as an enterprise-critical platform before, we invite you to grab your bifocals and

begin. (We'll be cramming a lot of information into this ad, which, given how much we managed to fit into our new servers, only makes sense.)

If there's one thing we've learned working with our customers, it's that you're running more and more mission-critical applications on your network. And if your network goes down, your business goes down. All of which makes the introduction of the new Compaq ProLiant Server even more timely.

The ProLiant is a new family of affordable, high-performance, easy-to-manage servers engineered specifically to provide the high availability you need for mission-critical networks. We've designed ProLiant in three different models, ranging from a single-processor configuration to a four-Pentium processor model.

Now, how can you be sure our server is truly a miracle and not a mirage? To begin with, there's Full Spectrum Fault Management, provided by Compaq Insight Manager technology and software that continually monitors over 800 aspects of the server's operating status. (For example, Drive Parameter Tracking checks 15 hard-drive parameters.) All of this information is constantly gathered, analyzed and then used to prevent, tolerate or recover from system problems.



If the performance of a monitored component drops below a specified level, our unique Pre-Failure Warranty kicks in. We'll actually replace a Compaq warranted drive or memory system free. Before it stops working. No downtime. Ringing cash registers. Happy boss.*



Still, no network's perfect. In the unlikely event problems occur, our server exhibits remarkable tolerance. Every ProLiant includes Compaq-designed hot-pluggable drives. ProLiant Models 2000 and 4000 come standard with advanced error-correcting memory and off-line backup processor features (whereby the server reboots

automatically to a second processor). And, most notably, the Compaq Smart SCSI Array Controller together with the ProLiant Storage System ensures mission-critical data integrity. Should a network problem bring the server down, the Rapid Recovery Systems of the ProLiant are designed to bring it back up.

'ER IS A MAINFRAME WITH AN ATTITUDE.



For example, Automatic Server Recovery 2 uses a historical record of server status and performance to perform an astonishing array of tasks. Like intelligently restarting the server, automatically correcting a variety of problems, and accessing a telephone pager to contact network administrators.

By now you'd expect us to have rethought server setup, configuration and OS installation, but you might be surprised by the results. Introducing SmartStart, a CD-ROM system that takes the headache out of getting your server up and running. ProLiant includes a CD-ROM drive and bundled CDs of optimized

Netware and other major operating systems. To get hooked up to your network operating system, simply call your dealer for an access code, enter it, answer a few questions, and leave. Minutes later—say, after you've enjoyed a cup of coffee and a jelly donut—you'll return to find an integrated OS fully installed and optimized for increased performance and improved management. And we'll keep you updated via CD when new operating system versions appear.



And finally, to accompany our new line of mission-critical servers, we're introducing mission-critical support. With ProLiant, we now offer extensive analysis, installation and service through our CompaqCare System Partners, a select group of highly trained systems experts backed by Compaq engineers. You can now choose 4-hour on-site warranty response upgrade** direct from Compaq. Again, there's our unique Pre-Failure Warranty. And, of course, all Compaq servers come with a 3-year on-site warranty, and 7-day-a-week, 24-hour-a-day technical support.

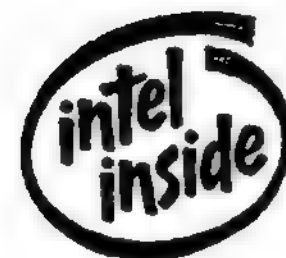


All in a surprisingly small box for not a whole lot of money. In fact, a DX2/66 Compaq ProLiant 1000 starts at about \$6000¹.

Which may help to explain the look your boss gives you when he hears how much money you've saved: stunned admiration. But you'll get used to that. It goes with the territory. For more information on the new Compaq ProLiant servers, or for the location of an authorized Compaq reseller near you, just call us at 1-800-345-1518. If you'd like to receive model, feature and specification information immediately via fax, select the FaxFax option. Or, if you'd like that information even sooner, just turn the page.



COMPAQ



THE NEW COMPAQ PROLIANT MISSION-CRITICAL SERVERS

ProLiant 1000

ProLiant 2000

ProLiant 4000

HIGH PERFORMANCE NETWORK SERVERS			
Processor	Intel 486DX2/66 or Pentium 60MHz	Intel 486DX/50 or Pentium 66MHz	Intel 486DX/50 or Pentium 66MHz
Architecture	TriFlex/PC One Processor	TriFlex with up to two symmetric processors	TriFlex with up to four symmetric processors
Network Interface	Up to 12 High-Speed Channels; NetFlex 2 with Packet Blaster Technology Standard		
Standard Disk Controller	Integrated Fast SCSI-2 and Smart SCSI Array Controller (selected models)		
Storage Capacity	550MB–112GB Internal/external	1050MB–140GB Internal/external	1050MB–140GB Internal/external
Typical Usage	Departmental network services—primarily NetWare	Departmental network application services—NetWare, NT and Unix	Application services for preemptive downsizing—NT and Unix
Transaction Rating	50–150 TPS	200–300 TPS	300–400 TPS
Estimated Starting Street Price [‡]	\$6,000	\$8,900	\$13,900
SERVER DEPENDABILITY AND AVAILABILITY			
Management	Second-generation Compaq Insight Manager (standard) combines with innovative hardware design to constantly monitor, assess and report server health and performance		
Fault Prevention	Insight Manager alerts you to server status changes in over 800 component parameters, allowing proactive server management backed by 3-Year Pre-Failure Warranty		
Fault Tolerance	Standard support for RAID levels 1,4,5; hot-pluggable drives; on-line spare drive; off-line backup processor [§] ; advanced ECC RAM [§]		
Fault Recovery	Standard rapid recovery services automatically return server to full operational status even in the event of a critical subsystem failure		
SIMPLICITY, EASE OF OWNERSHIP AND SUPPORT			
SmartStart	Standard CD-based intelligent hardware configuration and system software installation, providing simplified server configuration for NetWare, NT or Unix. (CD-ROM drive standard)		
System Warranty	Free Three-Year, On-Site Limited Warranty		
Pre-Failure Warranty	Three-Year, On-Site Warranty replacement of designated components that fall below preestablished thresholds		
4-Hour Warranty Response Upgrade	Optional Three-Year On-Site Warranty upgrade to 4-hour response		
Technical Support	Toll-free, 7 x 24 technical phone support from Compaq engineers		
CompaqCare System Partners	Highly trained, dedicated, third-party professionals who provide systems maintenance and comprehensive technical support		
QuickFind/PaqFax	Proactive notification and delivery of new technical information/7 x 24 fax response for updated specification, configuration and settings data		

COMPAQ

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CIRCLE 137 ON READER SERVICE CARD

Advanced Matrix Technology Inc.

AMT Accel-212d

AMT Accel-214d

AMT Accel-242d

AMT Accel-244d

AMT Accel-292d

AMT Accel-294d

AMT Accel-535d

BY BILL DYSZEL

Seven additions to Advanced Matrix Technology's line of heavy-duty forms printers offer easy configuration and convenient bottom-feed paper paths. The new printers include narrow- and wide-carriage pairs of 9-pin models (the \$764 AMT Accel-212d and the \$824 AMT Accel-214d), 24-pin models (the \$824 AMT Accel-242d and the \$890

year. The demand-document feeder features a straight-through vertical paper path and zero-tear-off operation so you can print on the very top of thick forms without waste. With all these models, it's also easy to keep two sources of paper loaded and quickly switch between them. You need only hit the form-feed button to park the stock currently in use, flip a lever, and hit the form-feed button again to load the forms on the other tractor.

Printer setup is controlled with AMT's patented Select-Dial, a revolving disk (somewhat like a rotary telephone dial) on the front control panel. Select-Dial lets you select fonts, emulations, and a variety of other settings without navigating a cumbersome menu structure. You need only spin the dial until the desired option is shown. You can also use it to adjust print margins fractionally by eye for optimal positioning of forms.

The narrow-carriage Accel-212d and its wide-carriage counterpart, the Accel-214d, exhibited impressive text quality for 9-pin printers. Roman and Sans Serif

Accel-294d excelled in high-speed draft mode, although they still fell short of the leaders. And in many cases, the dual-head printers were barely faster than their single-head 9-pin competitors. Text quality using the built-in Sans Serif and Times Roman fonts was commendable; graphics rendering was adequate but overly dark in IBM Proprinter emulation and grainy in Epson emulation.

The 24-pin Accel-535d managed the fastest output of AMT's machines, with draft performance that placed it among the top 24-pin printers tested in this roundup. For letter-quality printing—where speeds were closer to average—Courier, Gothic, Prestige Elite, and Trend fonts are standard. While graphics generally appeared ragged, color graphics were unexpectedly attractive; graphics output speed, however, was well below average.

All seven of these printers can support Postnet bar codes, and AMT also customizes models to provide features such as scalable fonts and additional emulations. Since the printers are sold primari-



AMT Accel-214d, AMT Accel-535d, AMT Accel-212d, AMT Accel-292d, AMT Accel-242d, AMT Accel-244d

AMT Accel-244d), and dual-head 9-pin models (the \$1,090 AMT Accel-292d and the \$1,190 AMT Accel-294d). There's also the \$2,095 AMT Accel-535d, a 24-pin color printer with unusually fast draft output. The folks at AMT explain their relatively high prices by pointing out that its units are designed for industrial applications, not home or small-business use.

The "d" suffix in these model names refers to the standard "demand-document" bottom feeder—a supplement to the rear tractor feeders in the similarly named AMT models we reviewed last

year. The demand-document feeder features a straight-through vertical paper path and zero-tear-off operation so you can print on the very top of thick forms without waste. With all these models, it's also easy to keep two sources of paper loaded and quickly switch between them. You need only hit the form-feed button to park the stock currently in use, flip a lever, and hit the form-feed button again to load the forms on the other tractor.

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The narrow-carriage Accel-212d and its wide-carriage counterpart, the Accel-214d, exhibited impressive text quality for 9-pin printers. Roman and Sans Serif

ly through value-added resellers and system integrators, we couldn't attain average street prices. But AMT estimates that its printers will typically sell at about 20 percent below list.

Advanced Matrix Technology Inc., 765 Flynn Rd., Camarillo, CA 93012; 800-992-2264, 805-388-5799; fax, 805-494-3087.

AMT Accel-212d List price: \$764; 250-sheet single-bin feeder, \$249; 12 black ribbons, \$75. Emulations: Epson FX, IBM Proprinter III, Lexmark 2380.

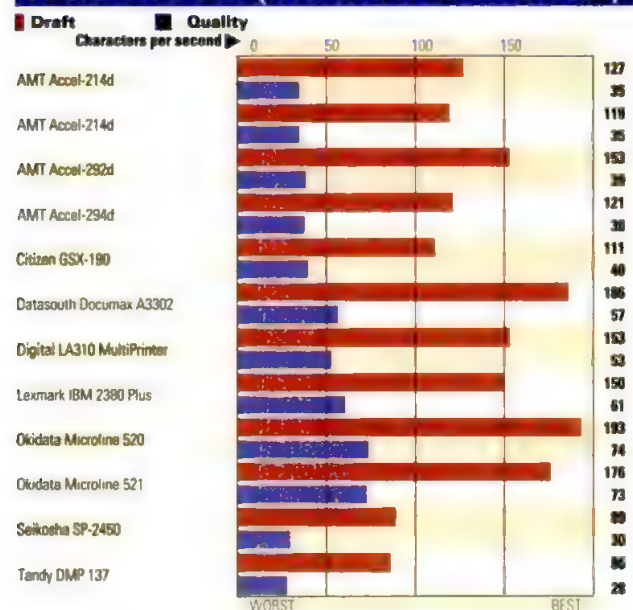
AMT Accel-214d List price: \$824; 250-sheet single-bin feeder, \$259; 500-sheet

Almost across the board, the Okidata Microline 520 and wide-carriage Okidata Microline 521 were the fastest of the tested 9-pin printers. The Datasouth Docu-max A3302, the Digital LA310 Multi-Printer, and Lexmark's IBM 2380 Plus all performed well on our Text Speed test but they lagged behind on our Microsoft Windows application tests. The lower-cost Seikosha SP2450 and Tandy DMP 137 consistently lagged behind the rest, with particularly low Text Speed scores in draft mode. The AMT Accel-294d placed second printing wide-carriage draft text, but was otherwise average.

The **Text Speed** test measures the printer's speed in producing one copy of a two-page business letter with 1-inch margins in 10-cpi type. We ran the test twice, once in draft mode and once in quality mode.

The **Graphics Speed** test measures the printer's speed in producing two copies of a complex single-page graphic containing a TIFF image, horizontal and vertical gray scales, and line art. A graphics print file is sent directly to the parallel port from DOS.

TEXT SPEED (NARROW CARRIAGE)



The **Word for Windows** test measures the printer's speed in producing a two-page report that uses multiple fonts and type styles. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

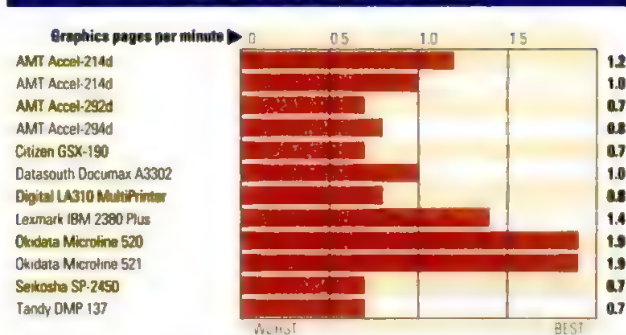
The **CorelDRAW** test measures the printer's speed in producing a single-page CorelDRAW graphic that contains a TIFF image, horizontal and vertical gray scales, and line art. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **Lotus 1-2-3 for Windows** test measures the printer's speed in producing a complex two-page spreadsheet that contains pie, bar, and line charts. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

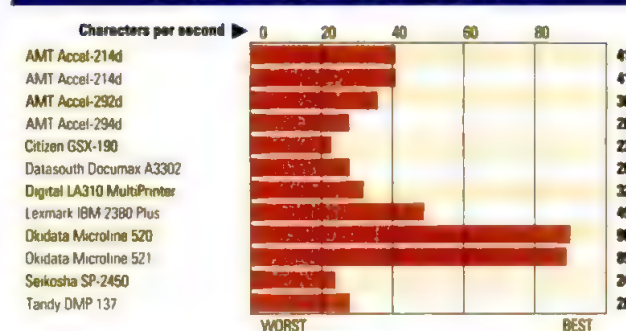
TEXT SPEED (WIDE CARRIAGE)

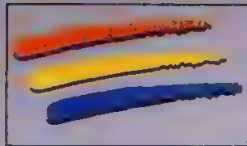


GRAPHICS SPEED



WORD FOR WINDOWS





Make a bigger splash with color

Panasonic knows that not everyone wants to spend the most money on the most features, but everyone wants the most features for their money. That's why the KX-P Series of Dot Matrix Printers includes models that offer Quiet Technology, Super Letter Quality and a color option for a lower price than any competing printer.



Near laser quality plus multi-part forms

The valuable features available on various models in the KX-P Series also include multiple paper paths, EZ™ Set  control panels, Adobe Type Manager® (for Windows® 3.0 and higher) and scalable fonts. Plus, Quiet Technology makes Panasonic printers welcome in any home or office.

THE MOST AFFORDABLE, QUIETEST PRINTER WITH SUPER LETTER QUALITY AND COLOR.

The outstanding construction quality of Panasonic Dot Matrix Printers provides such reliable operation that they are backed with a two-year limited warranty on parts and labor. No wonder PC Magazine's 1992 Service and Reliability Survey rated Panasonic printers "Excellent" on reliability, service and support.

Panasonic Dot Matrix Printers. More printer for your money.



*All other brand and company product names are trademarks or registered trademarks of their respective companies.

Quiet Times

Full color, without all the racket



Panasonic
Quiet KX-P2124
24-pin ATM SLO EZ Set Color Opt



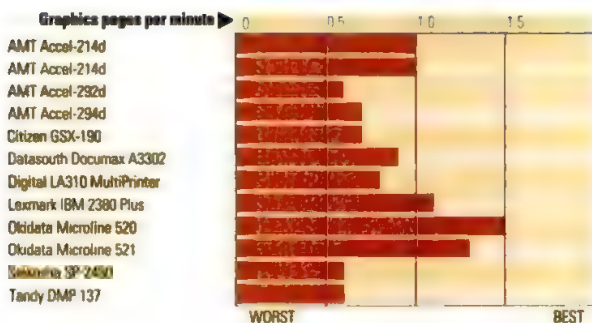
Panasonic Color Quiet Technology Models: KX-P2124 (Shown): 24-pin ATM SLO, EZ Set Color Opt KX-P2123, 24-pin ATM SLO Color Opt

For more information visit your Panasonic dealer or call 1-800-742-8086.

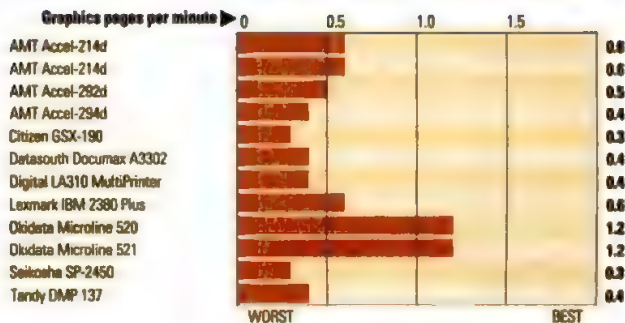
CIRCLE 070 ON READER SERVICE CARD

PQ11-PC

CORELDRAW



LOTUS 1-2-3 FOR WINDOWS



dual-bin feeder, \$429; 12 black ribbons, \$125. Emulations: Epson FX, IBM Proprinter, Lexmark 2381.

AMT Accel-242d List price: \$824; 504K RAM upgrade, \$295; 250-sheet single-bin feeder, \$249; 12 black ribbons, \$75. Emulations: Epson LQ, IBM Proprinter, Lexmark 2390.

AMT Accel-244d List price: \$890; 504K RAM upgrade, \$295; 250-sheet single-bin feeder, \$259; 500-sheet dual-bin feeder, \$429; 12 black ribbons, \$125. Emulations: Epson LQ, IBM Proprinter, Lexmark 2391.

AMT Accel-292d List price: \$1,090; 504K RAM upgrade, \$295; 250-sheet single-bin feeder, \$249; 12 black ribbons, \$75. Emulations: Epson FX, IBM Proprinter, Lexmark 2380.

AMT Accel-294d List price: \$1,190; 504K RAM upgrade, \$295; 250-sheet single-bin feeder, \$259; 500-sheet dual-bin feeder, \$429; 12 black ribbons, \$125. Emulations: Epson FX, IBM Proprinter, Lexmark 2381.

AMT Accel-535d List price: \$2,095; 504K RAM upgrade, \$295; 250-sheet single-bin feeder, \$349; 500-sheet dual-bin feeder, \$679; 500-sheet/50-envelope triple-bin feeder, \$794; six black ribbons, \$80; six color ribbons, \$95. Emulations: Diablo 630, Epson JX, Epson LQ, IBM Proprinter, Xerox 4020.

Circle 448 on reader service card

Citizen America Corp.

Citizen GSX-190

Citizen GSX-230

Digital Equipment Corp.

DECwriter 95

Tandy/Radio Shack Corp.

Tandy DMP 250

BY STEPHEN W. PLAIN AND
JOSEPH DESPOSITO

Citizen America Corp. packs a solid set of features into its low-cost printers, which it sells under both its own name and licenses to other vendors for relabeling. The 9-pin Citizen GSX-190 (\$199) and 24-pin Citizen

able fonts and are based on the Citizen GSX-240, which we reviewed last year.

The Citizen GSX-190 and Citizen GSX-230 can be purchased on the street for about \$165 and \$230, respectively. Test performance was consistently below average—more so for the GSX-190—and print speed on our Windows applications tests was particularly slow. (Citizen does not ship Windows drivers with these printers; they must be downloaded from the company's bulletin board system.)

Each printer comes with an internal push-and-pull tractor and six built-in fonts. The Citizen GSX-190 showed excellent print quality for a 9-pin printer, producing sharp text and plenty of graphics detail. The Citizen GSX-230's output was average, with some banding and splotchiness appar-

ent on graphics images. Each printer can be upgraded to support color with a \$59 kit that includes an easy-to-install color motor and a four-color ribbon.

The DECwriter 95 and Tandy DMP 250 are 24-pin models that are flexible and full of features. We expect the

DECwriter 95 to

sell for between \$250 and \$300 on the street, but the Tandy model is rarely discounted from its \$399.99 suggested retail price.

Both printers showed above-average performance in draft mode, particularly when printing graphics. But the



Citizen GSX-190, Citizen GSX-230, DECwriter 95, Tandy DMP 250

GSX-230 (\$299), nearly identical except for their printheads, are easy-to-use personal printers with color upgrade options. Citizen also manufactures Digital Equipment Corp.'s DECwriter 95 (\$319) and Tandy/Radio Shack Corp.'s Tandy DMP 250 (\$399.99). Both offer amenities such as scal-

Behold.



The HandBook®

Size

The difference between a 3-pound portable and a 4-pound portable doesn't sound like very much until you lug one around for hours. Then every ounce counts! HandBook users sing the praises of the

HandBook's size. It's big enough to be fully functional, but small enough to take anywhere effortlessly.

Battery

A 2.2Ah NiMH rechargeable battery comes with your HandBook. The battery lasts up to four hours with power management, about two hours without power management. You receive an AC adapter charger that charges the battery pack separately or in the HandBook.

The HandBook also has a

convenient alkaline battery pack option which enables you to use over-the-counter double-A batteries, too.

Drive

The HandBook 486 includes an 80MB or 130MB hard drive for today's larger Windows programs and files. With the Interlink software utility and serial download cable provided, you can easily transfer data between the HandBook and other PCs.

Display

Looking at the HandBook's VGA display is easy on your eyes. It's the largest backlit display of any subnotebook in this world or the next, and you can use it comfortably in all lighting situations.

Suspend/Resume

Suspend/resume is one of the features HandBook users rejoice about! It allows you to stop work any time, leave all your Windows applications open, then resume instantly at exactly the same chapter and verse without losing anything or restarting the system. It's great for taking notes in meetings!



The ColorBook

Dual-Scan STN Display

Dual-scan STN color is the latest technology in portable color displays. The incredible quality of the LCD coupled with local bus video gives you truly out-of-this-world graphics. You can display up to 256 colors with the ColorBook running in VGA mode.

Battery

You can have faith that your rechargeable battery will last up to four hours with power management, over two hours without power management. You also get an AC adapter/charger capable of fast-charging the battery separately or during operation in the ColorBook.

Suspend/Resume

Gateway 2000 HandBook users like suspend/resume so much we designed it into the ColorBook as well!

Drives

The ColorBook includes a floppy drive and a high-capacity hard drive. The hard drive is removable — a handy feature for companies where notebooks are checked out to multiple users. Upgrading to a larger drive in the future is also much easier with the ColorBook's removable hard drive.

External Ports

The ColorBook has parallel, serial, PS/2 and VGA ports. You can use it with an external mouse, keyboard and monitor. The ColorBook supports simultaneous video and allows you to display your ColorBook screen on an external monitor in up to 1024 x 768 resolution.

Your Calling

Surely one of these "good books" is a match made in heaven for your needs. Give us a call. We'll be eternally grateful!



GATEWAY2000

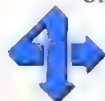
"You've got a friend in the business."®

8 0 0 - 8 4 6 - 2 0 2 9

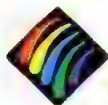
The Gateway 2000 HandBook® And ColorBook Are Simply Divine!

If you're looking for the perfect portable PC for your next pilgrimage, look no further than the HandBook and ColorBook from Gateway 2000.

One of these notebooks is the answer to your prayers.

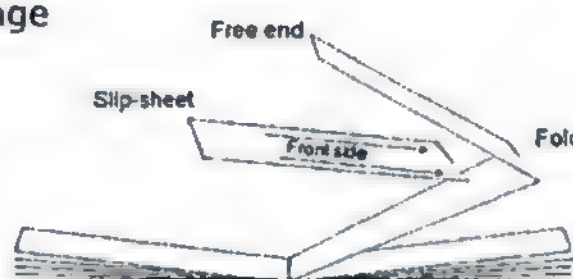


The HandBook 486 is the next generation of the original HandBook, the product that was the genesis of an entirely new portable PC category dubbed "subnotebook" computers. The new product is blessed with many improvements while retaining all the things people love about the first model. With the HandBook 486, you get the smallest Windows™ PC in this world — and when using a 486DX2 processor, the HandBook is by far the most powerful PC of its size. New HandBook 486 models include SL Enhanced Intel486® CPUs and come with 4MB RAM (expandable to 20MB), 80 or 130MB hard drive, backlit VGA display, built-in pointing device, and one PCMCIA slot. All this and the HandBook 486 still weighs under three pounds, is smaller than the day planners many people carry, and starts at \$1,495. Once you get your hands on a HandBook 486, you'll be a HandBook convert.



The ColorBook is the 486 color notebook that's priced the same as other companies' black-and-white models. With the ColorBook, you get bright, crisp color graphics from the dual-scan STN display. You get a small, easy-to-carry notebook. The ColorBook weighs less than 5.7 pounds and measures 11.7" x 8.5" x 1.77". It's one of the thinnest color products on the market. And, you get 486 performance. ColorBook models are based on SL Enhanced Intel486® processors, and include the virtues of a 1.44MB floppy drive, 4MB of RAM (upgradeable to 20MB), a large, fast hard drive, integrated track ball and two PCMCIA Type II card slots. All this starting at under \$2,000. Heavenly!

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



Foldout slip-sheet

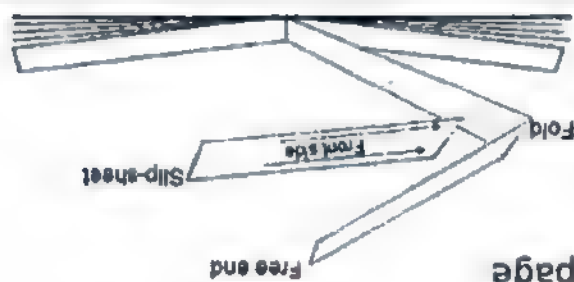


GbsSlipSheet-001

Inverted Foldout slip-sheet

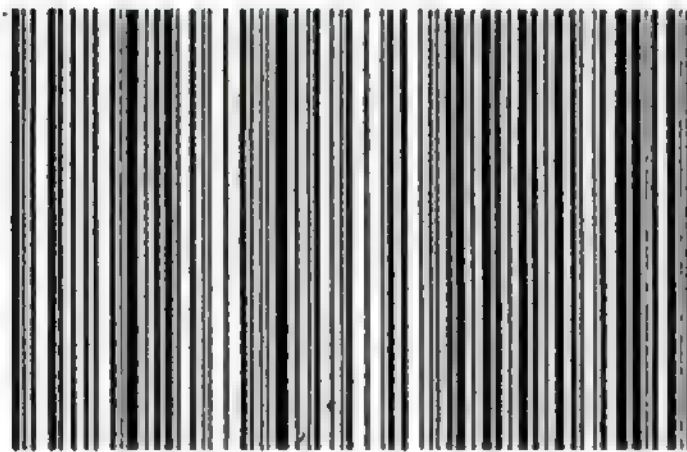
Folded edge of the page

1. Open the foldout page
2. Insert this sheet with
 1. Front side touching the free page
 2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet



1. Follow instructions on the other side

Inverted Back



GbsSlpBack-001B

Back

1. Follow instructions on the other side

The Good Books.



Good Book Review

COLORBOOK 486SX-25

- Weight: Under 5.7 Lbs.
- Dimensions: 11.7" x 8.5" x 1.77"
- 25MHz SL Enhanced Intel® 486SX CPU
- 4MB RAM (expandable to 20MB)
- 3.5" 1.44MB Diskette Drive
- Removable 80MB IDE Hard Drive
- 9.4" VGA Dual-Scan STN Color Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 2 PCMCIA Type II (or 1 Type III) Slots
- Integrated Track Ball (2 Buttons)
- 85-Key Keyboard
- Parallel, Serial & PS/2® Ports
- External VGA Port
- MS-DOS 6® and Windows™ 3.1

\$1995

HANDBOOK® 486SX-25

- Weight: 2.9 Lbs.
- Dimensions: 9.75" x 5.9" x 1.6"
- 25MHz SL Enhanced Intel 486SX CPU
- 4MB RAM (expandable to 20MB)
- 80MB IDE Hard Drive
- 7.9" Backlit VGA Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 1 PCMCIA Type II Slot
- Integrated Pointing Device
- 78-Key Keyboard
- Parallel, Serial & PS/2 Ports
- MS-DOS 6, Windows 3.1, Interlink and Serial Download Cable

\$1495

HANDBOOK COMBOS

HandBook Traveler's Packs:

- Case, extra battery, alkaline battery pack & PCMCIA 96/24 fax/modem. **\$379**
- Case, extra battery, alkaline battery pack & PCMCIA TelePath fax/modem. **\$499**

HandBook Presenter's Pack:

- PCMCIA VGA adapter, Asymetrix® Compel & case. **\$319**

COLORBOOK 486SX-33

- Weight: Under 5.7 Lbs.
- Dimensions: 11.7" x 8.5" x 1.77"
- 33MHz SL Enhanced Intel 486SX CPU
- 4MB RAM (expandable to 20MB)
- 3.5" 1.44MB Diskette Drive
- Removable 170MB IDE Hard Drive
- 9.4" VGA Dual-Scan STN Color Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 2 PCMCIA Type II (or 1 Type III) Slots
- Integrated Track Ball (2 Buttons)
- 85-Key Keyboard
- Parallel, Serial & PS/2 Ports
- External VGA Port
- MS-DOS 6 and Windows 3.1

\$2395

HANDBOOK 486DX2-40

- Weight: 2.9 Lbs.
- Dimensions: 9.75" x 5.9" x 1.6"
- 40MHz SL Enhanced Intel 486DX2 CPU
- 4MB RAM (expandable to 20MB)
- 130MB IDE Hard Drive
- 7.9" Backlit VGA Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 1 PCMCIA Type II Slot
- Integrated Pointing Device
- 78-Key Keyboard
- Parallel, Serial & PS/2 Ports
- MS-DOS 6, Windows 3.1, Interlink and Serial Download Cable

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COLORBOOK COMBOS

ColorBook Traveler's Packs:

- Case, extra battery & PCMCIA 96/24 fax/modem. **\$329**
- Case, extra battery & PCMCIA TelePath fax/modem. **\$449**

COLORBOOK 486DX-33

- Weight: Under 5.7 Lbs.
- Dimensions: 11.7" x 8.5" x 1.77"
- 33MHz SL Enhanced Intel 486DX CPU
- 4MB RAM (expandable to 20MB)
- 3.5" 1.44MB Diskette Drive
- Removable 170MB IDE Hard Drive
- 9.4" VGA Dual-Scan STN Color Display
- NiMH Battery & AC Pack
- Suspend/Resume Feature
- 2 PCMCIA Type II (or 1 Type III) Slots
- Integrated Track Ball (2 Buttons)
- 85-Key Keyboard
- Parallel, Serial & PS/2 Ports
- External VGA Port
- MS-DOS 6 and Windows 3.1

\$2695

OPTIONS

PCMCIA Cards:

- TelePath™ fax/modem — 14,400bps send-receive fax, 14,400bps modem. **\$319**
- Fax/modem — 9,600bps send-receive fax with 2,400bps modem. **\$199**
- Ethernet adapter. **\$189**
- Token Ring adapter. **Call**
- HandBook VGA adapter. **\$229**

Batteries:

- 2.2Ah NiMH batteries. **\$89 each**
- HandBook alkaline battery pack. **\$29**

Floppy Drive:

- HandBook 3.5" 1.44MB external floppy drive. **\$99**

Cases:

- Padded, soft-sided black cases custom-designed for ColorBook or HandBook. ColorBook **\$49** HandBook **\$55**
- Extended VIP Warranty:

- 24-hour turnaround on factory warranty service for one year. Must be purchased at point of sale. Call for details. **\$100**
- 4MB or 16MB RAM Upgrades:
- Due to the volatility of the DRAM market, please call for pricing.



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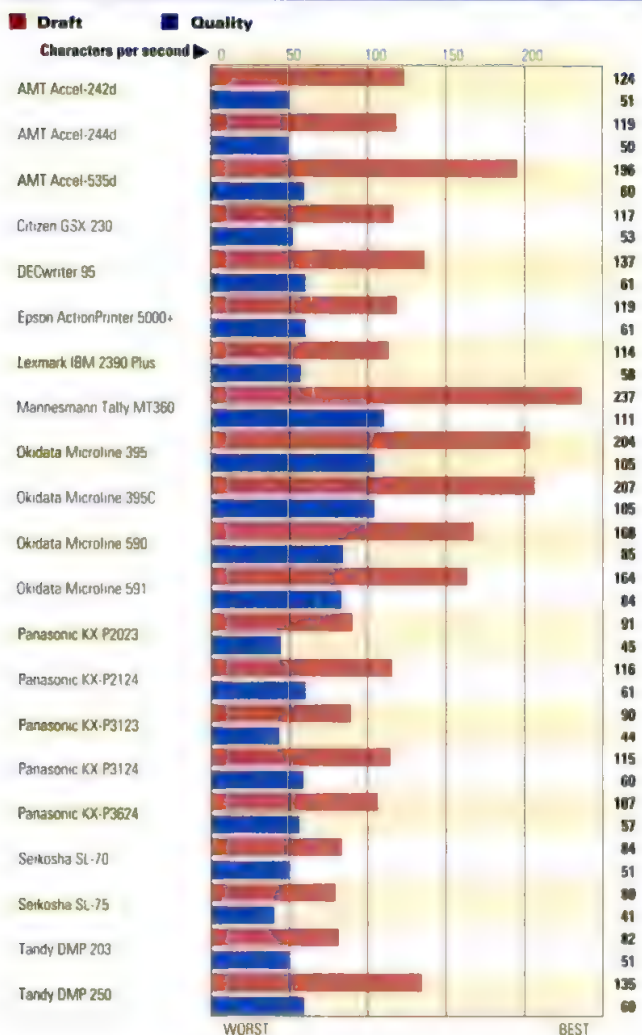
Among the 24-pin entries, the Mannesmann Tally MT360 workhorse was the clear performance leader. Its performance on our Text Speed test was impressive; on our Graphics Speed and Microsoft Windows applications tests, it was downright astounding. The Okidata Microline 395 and Okidata Microline 395C closely shadowed the MT360's performance in text mode but dropped off to about average when printing graphics. In the under-\$500 price range, the Epson

ActionPrinter 5000+ and Tandy DMP 250 showed the best overall performance in both Windows and non-Windows applications, followed closely by the Panasonic KX-P2124. The DECwriter 95 also performed well in DOS applications, but fell behind in our Windows-based tests.

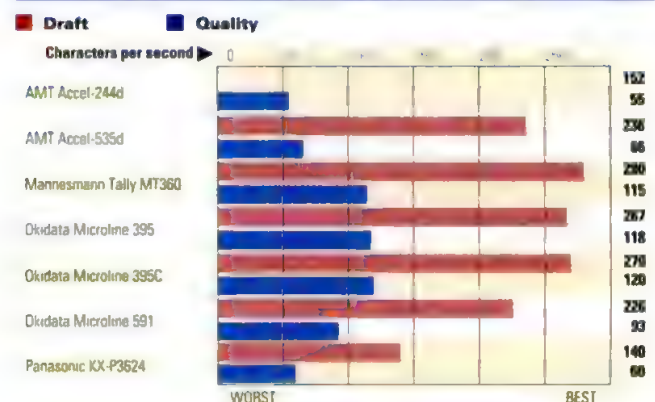
The **Text Speed** test measures the printer's speed in producing one copy of a two-page business letter with 1-inch margins in 10-cpi type. We ran the test twice, once in draft mode and once in quality mode.

The **Graphics Speed** Test measures the printer's speed in producing two

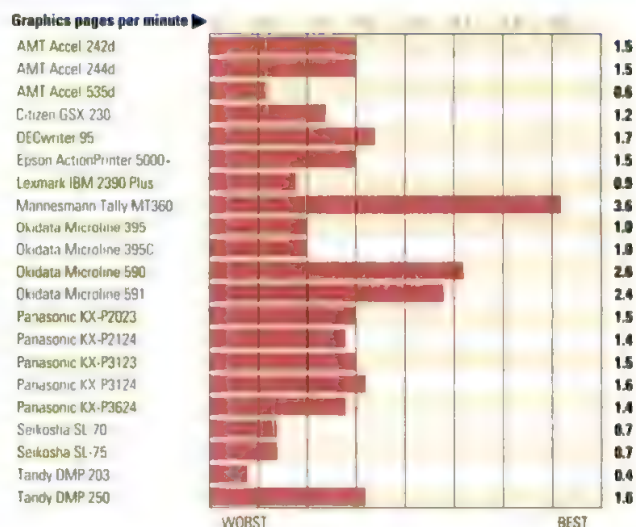
TEXT SPEED (NARROW CARRIAGE)



TEXT SPEED (WIDE CARRIAGE)



GRAPHICS SPEED



Happy Holidays from Austin!

NEW!

Austin Power with Pentium™ Processor

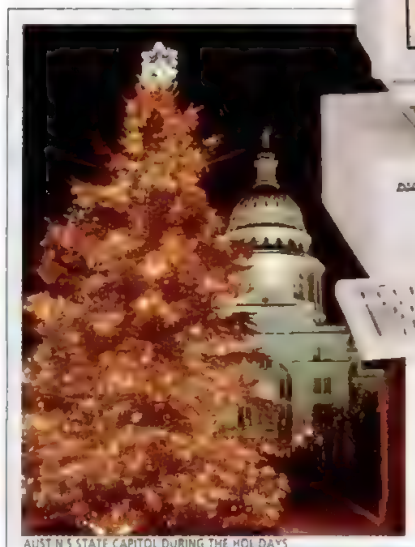
Austin makes Intel's fastest processor affordable!

With Austin Power, you don't have to compromise between affordability and performance. With its Pentium processor, 256 KB cache, and PCI local bus accelerated video controller with 2 MB of VRAM, this system's Windows performance is nothing short of phenomenal. The 525 MB 10ms hard drive and Sony double-spin CD-ROM drive have the capacity and speed for applications that demand Pentium processing power. The 15" digital monitor displays up to 1280 x 1024 pixels. With its multi-resolution memory, you never have to fiddle with monitor controls as you change applications. For the ultimate in productivity, get Austin Power.

Phenomenal!

Pentium™ Processor

HOLIDAY PRICE
\$3,999†



AUSTIN'S STATE CAPITOL DURING THE HOLIDAYS

Austin is the place to go for the holidays.

Friendly, full of welcome, and filled with great things to see and do. Austin Computer Systems is celebrating the season by offering some really friendly pricing on their most popular systems.

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486 MediaMagic™ Systems

Austin brings you the multimedia revolution!

While others are starting to add CD-ROM drives to their systems, Austin delivers a complete multimedia computing solution including the MediaMagic ISP-16 Audio Board, amplified speakers, Sony double-spin CD-ROM drive, and a selection of four CD-ROM titles. This system features the Intel 486SX-33 processor, local bus Windows accelerated video, 3.5" floppy drive, and 212 MB hard drive. Topped with our 14" Super VGA monitor, this system is perfect for home computing, education, or small office use.

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486SX-33

SPECIAL HOLIDAY PRICE
\$1,749†



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Austin's MediaMagic Pro systems include the DSP-16 Plus Audio Board with digital signal processor and wavetable MIDI synthesis, the same technology used by professional musicians. This system includes a 340 MB hard drive and 1 MB VL-Bus Windows accelerator. The Toshiba 3401 double-spin CD-ROM drive offers the industry's fastest access time.

Multimedia Power!

486DX2-66

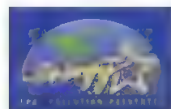
SPECIAL HOLIDAY PRICE
\$2,999†



February 11 1992
Austin 486-33
Winstation



† Promotional pricing.



486 for Home, Office or Dorm

Fast and Easy!

Never has so much power been so affordable. This 486SX-33 MHz system features accelerated local bus video and 212 MB hard drive. The preinstalled DOS and Windows software requires no installation, so you'll be creating letters, mailing lists, and budgets within minutes of opening the box! And our Energy Star™ design saves you money by using less electricity.

Great Value!

486SX-33

SPECIAL HOLIDAY PRICE
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Feature Rich 486 Performance Systems

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Austin's 486 Performance Systems feature accelerated VL-Bus video with 1 MB of DRAM, dual floppy drives, larger chassis, 15" SVGA monitor, and ZIF socket for easy upgradability to Pentium™ technology. The 128 KB level 2 cache improves performance 19% over cacheless systems on DOS and Windows applications.

Best Buy!

486DX2-66

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Free Holiday Gift!

With every system purchased by December 31, 1993, your choice of:

- Internal 2400 bps Modem with send/receive Fax and Trio DataFax software
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- Lotus 1-2-3 for Windows
- Ami Pro 3.0 for Windows
- Upgrade from 212 MB hard drive to 250 MB hard drive

Austin Power Systems

Intel Pentium CPU Operating at 60 MHz
8 MB RAM Expandable to 64 MB
256 KB Level 2 Cache
3.5" Floppy Drive
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15" Digital Memory Non-Interlaced Super VGA Color Monitor
Compact Desktop Case
Three 5.25" HH Bays, Two Internal 3.5" Bays
200 Watt Power Supply
Four 16-Bit ISA, Two 64-Bit PCI, and One PCI/ISA Slot

Pentium	525 MB	10ms	IDE	\$3,999
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4 MB RAM Expandable to 32 MB
3.5" Floppy Drive
MediaMagic ISP-16 with Sony 31A/03 Double-Spin CD-ROM and Speakers
Accelerated Local Bus Video with 512 KB DRAM
14" Super VGA Monitor
Low Profile Case
Two 5.25" HH Bays, One 3.5" Bay, One Internal 3.5" Bay,
150 Watt Power Supply
Five 16-bit ISA Slots
Compatible with Sound Blaster and Windows Sound System
EPA Energy Star Approved Power Conservation

486SX-33	SVGA	212 MB	13ms	\$1,749
486DX-33	NI SVGA	250 MB	13ms	1,999
486DX-66	NI SVGA	340 MB	13ms	2,349

486 MediaMagic Pro Systems

8 MB RAM Expandable to 64 MB
3.5" Floppy Drive
MediaMagic DSP-16 with Toshiba 200ms CD-ROM and Speakers
Super Accelerated Local Bus Video with 1 MB DRAM
15" Digital Memory Non-Interlaced Super VGA Color Monitor
Compact Desktop Case
Three 5.25" HH Bays, Two Internal 3.5" Bays
200 Watt Power Supply
Compatible with Sound Blaster and Windows Sound System
Four 16-Bit ISA and Two 32-Bit VESA/ISA Slots

486DX2-50	340 MB	13ms	\$2,749
486DX2-66	340 MB	13ms	2,999

486 For Home, Office, Dorm

4 MB RAM Expandable to 32 MB
3.5" Floppy Drive
Accelerated Local Bus Video with 512 KB DRAM
14" Super VGA Monitor
Low Profile Case
Two 5.25" HH Bays, One 3.5" Bay, One Internal 3.5" Bay,
150 Watt Power Supply
Five 16-bit ISA Slots
EPA Energy Star Approved Power Conservation

486SX-25	212 MB	13ms	\$1,299
486SX-33	212 MB	13ms	1,349

486 Performance Systems

8 MB RAM Expandable to 64 MB
128 KB Level 2 Cache
Dual 5.25" and 3.5" Floppy Drive
STB Powergraph C33 VL-bus 1 MB Windows Accelerator
15" Digital Memory Non-Interlaced Super VGA Color Monitor
Desktop Case
Three 5.25" HH Bays, Two 3.5" HDD Bays
200 Watt High Efficiency Power Supply
Four 16-Bit ISA and Two 32-Bit VESA/ISA Slots

486DX2-50	340 MB	13ms	\$2,199
486DX2-66	425 MB	13ms	2,449

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Happy Holidays!

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In the dog-eat-dog world of business presentations, we just made you a pit bull with the legs of a greyhound.

In dog racing as in business, if you're not leading the pack, the view seldom changes. Meet your new leg up on the competition: the Tektronix Phaser™ 200 color printer. It's lean, mean, and very very fast. Of course, you don't have to take our word for it, *PC Computing* magazine just called it the best overall presentation printer in the business. So much for the other guys.

But what is it that makes the Phaser 200 so good? For starters, the ink coverage and image quality are, in a word, brilliant. We at Tektronix didn't get to be the award-winning leader in color printers by sitting on our hands. Then there's speed. You get all of this great color at two pages per minute, which is nearly as fast as a regular black and white printer. Can you say increased productivity?



On top of all this, the Phaser 200 is a work group printer that gives you the advantages of a laser printer. Including true Adobe® PostScript™ Level 2, networkability, separate paper and transparency trays and price (did we happen to mention the Phaser 200 has a list price of only \$3,695?).

For more information or a free output sample, come into your nearest Tektronix dealer or call us at 800/835-6100,

Dept. 31E. For faxed information, call 503/682-7450, and ask for document # 5001.

In closing, we just want to remind you that your competition is also reading this ad. And they're extremely hungry. So when choosing a presentation printer, the choice is quite simple. You can either eat, or be eaten. Bon appétit.

Tektronix

Benchmark Tests: 24-Pin Dot Matrix Printers

ENDS

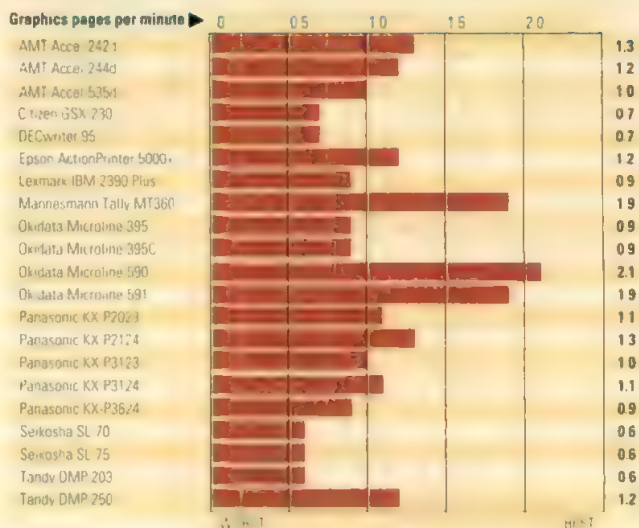
copies of a complex single-page graphic containing a TIFF image, horizontal and vertical gray scales, and line art

The **Word for Windows** test measures the printer's speed in producing a two-page report that uses multiple fonts and type styles. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

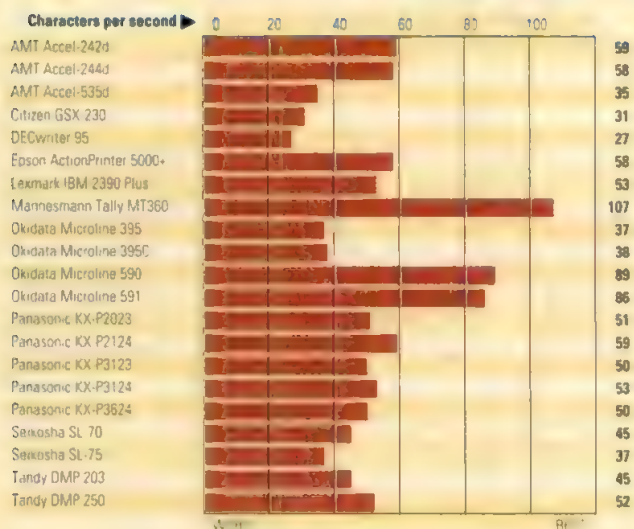
The **CorelDRAW** test measures the printer's speed in producing a single-page CorelDRAW graphic that contains a TIFF image, horizontal and vertical gray scales, and line art. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **Lotus 1-2-3 for Windows** test measures the printer's speed in producing a complex two-page spreadsheet that contains pie, bar, and line charts. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

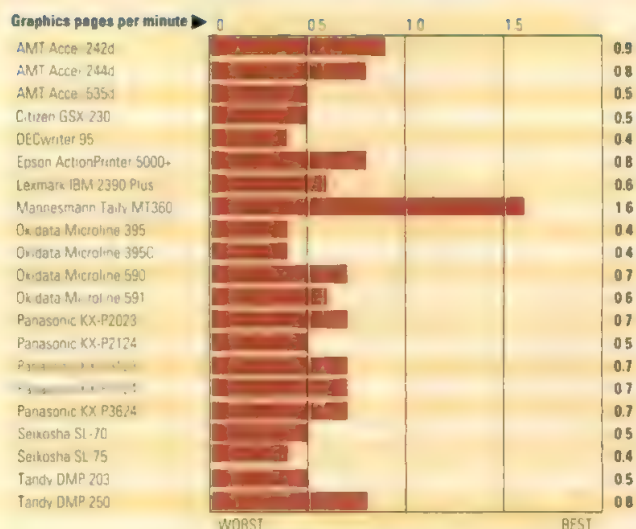
CORELDRAW



WORD FOR WINDOWS



LOTUS 1-2-3 FOR WINDOWS



DECwriter 95 lagged on our Windows applications tests—a result of poor drivers. The Tandy DMP 250 stopped printing on the third page of our graphics tests when its printhead became too hot.

The Tandy DMP 250 offers 9 letter-quality fonts; the DECwriter 95 offers 13. Among these, Roman and Sans Serif fonts are scalable from 8 to 40 points in both DOS and Windows. Text output quality was average; the DECwriter 95 produced slightly sharper graphics than the Tandy DMP 250. Fonts and other configuration options for both printers are

controlled from their front panels.

Both printers handle paper exceptionally well. A convertible tractor mechanism does either push or pull service; the latter is useful for feeding multipart forms through a bottom slot. A paper rack for feeding individual single sheets is standard. Paper loading and parking are automatic.

In sum, these units combine above-average features and performance at prices right for personal use.

Citizen America Corp., 2450 Broadway, #600, Santa Monica, CA 90404; 310-453-0614; fax, 310-453-2814.

Citizen GSX-190 List price: \$199; color upgrade kit (includes color ribbon), \$59; automatic 100-sheet single-bin feeder, \$169; manual 50-sheet single-bin feeder, \$59; black ribbon, \$6.99; color ribbon, \$25.99; serial interface, \$49. Emulations: Citizen 200GX, Epson EX, Epson FX, Epson JX, Epson MX, IBM Proprinter.

Citizen GSX-230 List price: \$299; color upgrade kit (includes color ribbon), \$59; 100-sheet single-bin feeder, \$169; 50-sheet manual feeder, \$59; black ribbon, \$7.99; black film ribbon, \$11.50; color ribbon,

8-Bit.



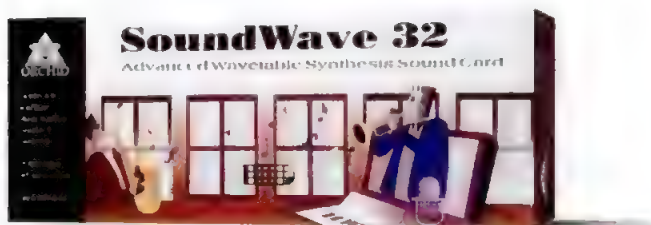
Good.

16-Bit.



Better.

Signal Processor.



InfriggIncredible

Fire up your favorite game and get ready to be blown away. Because now every sound you couldn't hear with those other boards is going to come storming out of your PC with intensity like you've never heard before. Introducing Orchid's signal processing SoundWave 32.

SoundWave 32 is nothing short of a revolution in sound, with its own rocket-quick RISC signal processing chip (DSP). While other boards try to stuff their puny sounds through slow, outdated FM chips, SoundWave 32's 20 megahertz signal processor rushes out rich, 16-bit sound. With incredible clarity and separation.

And there's more. Not only do you get dual CD-ROM interfaces and free stuff like stereo speakers, a microphone and a stereo cable, but SoundWave 32 also gives you amazing wavetable sampled sound. So when the game calls for a killer riff, you don't

just hear a computer simulation of a guitar, you hear the real, recorded instrument.

Of course, SoundWave 32 is compatible with everything — SoundBlaster, AdLib, General MIDI, Microsoft Windows Sound System, and Roland MPU-401 MIDI interface, and for you game players, Roland MT-32 sound module. And with just a simple change of software, its signal processor will handle any new sound format that comes along.

So if good isn't good enough, get crisp, signal processed sound and state-of-the-art wavetable technology, all for the price of the lesser boards. Get infriggIncredible sound and value. Get SoundWave 32 from Orchid. To hear more, call 1-800-7-ORCHID today.





Benchmark Tests: Line Printers

Both of the expensive line printer emulators we tested were speedy, but the hammer-driven Mannesmann Tally MT691, priced at \$9,999, was by far the faster of the two in both Text and Graphics Speed tests. The \$8,995 Output Technology EuroLine 800's performance was outstanding, but its price-performance ratio doesn't match the MT691's.

The **Text Speed** test measures the printer's speed in producing one copy of a two-page business letter with 1-inch margins in 10-cpi type. We ran the test twice, once in draft mode and once in quality mode.

The **Graphics Speed** test measures the printer's speed in producing two copies of a complex single-page graphic containing a TIFF image, horizontal and vertical gray scales, and line art.

The **Word for Windows** test measures the printer's speed in producing a two-page report that uses multiple fonts and type styles. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **CorelDRAW** test measures the printer's speed in producing a single-page CorelDRAW graphic that contains a TIFF image, horizontal and vertical gray scales, and line art. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

The **Lotus 1-2-3 for Windows** test measures the printer's speed in producing a complex two-page spreadsheet that contains pie, bar, and line charts. We tested each printer with the Microsoft Windows driver recommended by the printer's manufacturer.

\$25.99; serial interface, \$49. Emulations: Citizen GSX, Epson LQ, IBM Proprinter. Circle 449 on reader service card

Digital Equipment Corp., 146 Main St., Maynard, MA 01754-2571; 800-344-4825, 508-493-5111; fax, 800-234-2298.

DECwriter 95 List price: \$319; 115-sheet single-bin feeder, \$119; black ribbon, \$7; color ribbon, \$25; serial interface, \$48. Emulations: Epson ESC/P2, Epson LQ, IBM Graphics Printer, IBM Proprinter. Circle 451 on reader service card

Tandy/Radio Shack Corp., 1500 One Tandy Center, Fort Worth, TX 76102; 817-390-3011.

Tandy DMP 250 List price: \$399.99; black ribbon, \$10.99; color ribbon, \$29.99. Emulations: Citizen GSX, Epson LQ, IBM Proprinter. Circle 459 on reader service card

Datasouth Computer Corp.

Datasouth Documax A3302

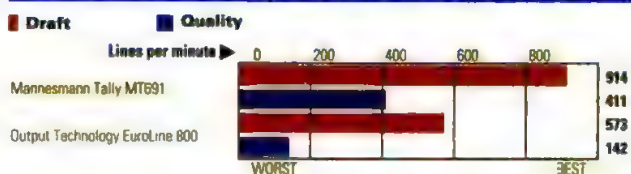
BY BRUCE BROWN

Datasouth Computer Corp.'s space-saving Datasouth Documax A3302 takes aim at heavy-duty narrow-carriage forms-printing applications. With two nearly-

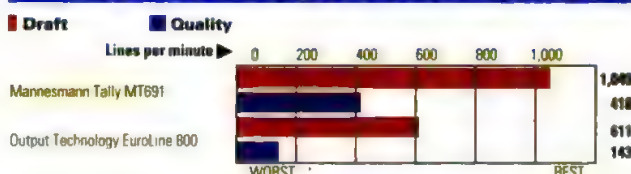
vertical paper paths, this \$2,195 (about \$1,750 on the street) printer is rated to handle nine-part forms and can print across 8.8 inches on paper that is up to 10.6 inches wide.

Both tractors on the Documax A3302 are on the bottom front of the printer. It's easy to switch between continuous forms loaded on both tractors; you need only press the paper-parking button twice, and one is retracted while the other is pulled into position. The printer is also easy to configure, with a 16-character LCD and a setup menu conveniently located under a flip-up control panel. You can save as

TEXT SPEED (NARROW CARRIAGE)



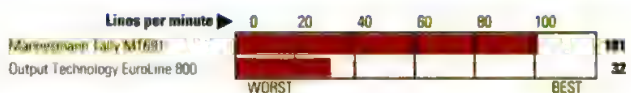
TEXT SPEED (WIDE CARRIAGE)



GRAPHICS SPEED



WORD FOR WINDOWS



CORELDRAW



LOTUS 1-2-3 FOR WINDOWS



THIS SHOULD GIVE YOU OF WHY WE CREATED AN

The image you see over there started out attached to the image you see over here. But as it made its way to the printer, the computer it was created on recognized a problem: 11 x 17 pages can't fit on

Laser printers were built to help put an end to all of that. They can print 11 x 17 pages in a single pass. They come with up to three paper

8 1/2 x 11 paper.

And so, out came the electronic scissors.

Now, if you're like a lot of people, you know all about this routine.

And you know how it feels to walk into a meeting with a presentation that contains hours of blood, sweat and tears, and a big fat strip of tape going right down the middle of it. Enough said.

COMPAQ PAGEMARQ Network



trays, which lets you switch between paper sizes without leaving your desk, so you don't have to pull one paper tray out and replace it with another, only to have your neighbor

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B

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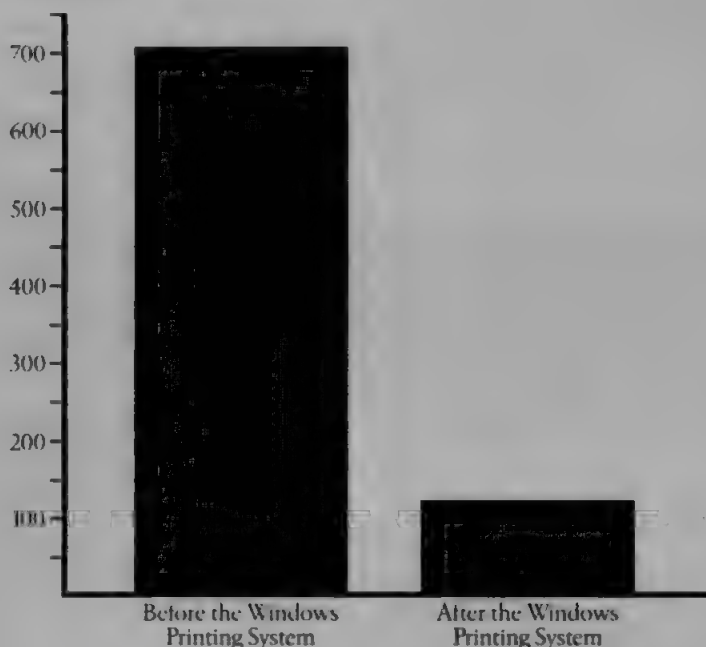
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PRINTERS
Dot Matrix



many as 4 user-defined configurations (and as many as 17 with the optional EEPROM upgrade).

Don't buy the Documax A3302 for fine-quality text printing or for great graphics output. Though it includes bar code capabilities and five near-letter-quality fonts, its text quality is typical of a 9-pin printer. Graphics printed so dark as to be nearly illegible, and printing speed was moderate but not blazing.

Datasouth makes other Documax models with different paper-feed configurations and twinaxial or coaxial network interfaces. The Documax A3302 is not the right printer for general-purpose use, but it excels when printing on very thick narrow-carriage forms.

Datasouth Computer Corp., P.O. Box 240947, Charlotte, NC 28224; 800-476-2120, 704-523-8500; fax, 704-523-9298.

Datasouth Documax A3302 List price: \$2,195; 128K memory upgrade, \$125; black ribbon, \$19.95. Emulations: Epson FX, IBM Proprinter.

Circle 450 on reader service card

Digital Equipment Corp.

Digital LA310 MultiPrinter

BY BRUCE BROWN

It's easy to connect the 9-pin Digital LA310 MultiPrinter to multiple machines, thanks to its port-switching capabilities and automatic emulation detection. With a \$599 list price—less than half the cost of previous MultiPrinter models—the LA310 MultiPrinter is a good deal if you're looking for a heavy-duty wide-carriage forms printer.

The unit comes standard with serial and parallel ports, and it automatically senses which port is receiving data so two computers or terminals can be connected

at the same time. Each port can be assigned any of the three standard emulations: Digital PPL2 (ANSI), Epson FX-1050, and IBM Proprinter III. The control panel allows you to select port configurations, a quiet mode, and near-letter-quality, draft, or high-speed draft modes. The printer's hierarchical setup menu and current configuration can be printed on paper.

Two internal push tractors, which feed off two vertical paper paths, are standard. Equipped with an optional \$89 external pull tractor, the LA310 MultiPrinter can print forms of up to five parts and 16 inches wide; without the pull tractor, four-part forms are the rated maximum. You can hand feed single sheets, multi-part forms, and envelopes, but the LA310 MultiPrinter is at its best printing on continuous forms. Its text and graphics output speeds were average among the tested 9-pin printers.

The unit has only a single near-letter-quality typeface (Courier), and graphics output was typical for a 9-pin printer; but then, this printer isn't built to generate pretty correspondence.

With its likely \$500 street price, the LA310 MultiPrinter is among the less expensive machines targeted at heavy-duty forms printing.

Digital Equipment Corp., 146 Main St., Maynard, MA 01754-2571; 800-344-4825, 508-493-5111; fax, 800-234-2298.

Digital LA310 MultiPrinter List price: \$599; pull-up tractor, \$89; six black ribbons, \$40. Emulations: Digital PPL2 (ANSI), Epson FX, IBM Proprinter.

Circle 451 on reader service card

Epson America Inc.

Epson ActionPrinter 5000+

BY BRUCE BROWN

Targeted at home, home-office, and small-business use, the 24-pin, narrow-carriage Epson ActionPrinter 5000+ (\$349) offers scalable internal fonts and flexible paper handling. The

ActionPrinter 5000+ is virtually the same printer as the Epson LQ-570+; the two differ only in packaging design and distribution. Epson America sells the ActionPrinter line through consumer retail channels and the LQ series through computer dealers and mail-order houses.

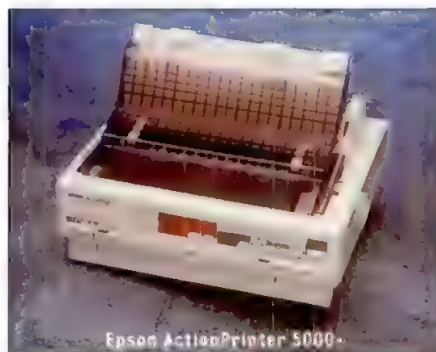
Since the two models are functionally identical, we tested only one—the ActionPrinter 5000+. In addition to ten internal bitmapped fonts, the ActionPrinter 5000+ includes four scalable fonts, which can be sized from 8 to 32 points in Windows and DOS word processing applications that support the Epson

ESC/P2 printer control language. During testing, the printer produced fine-quality text output at an above-average speed. We found the ActionPrinter 5000+ acceptable for very light graphics output, but it does not

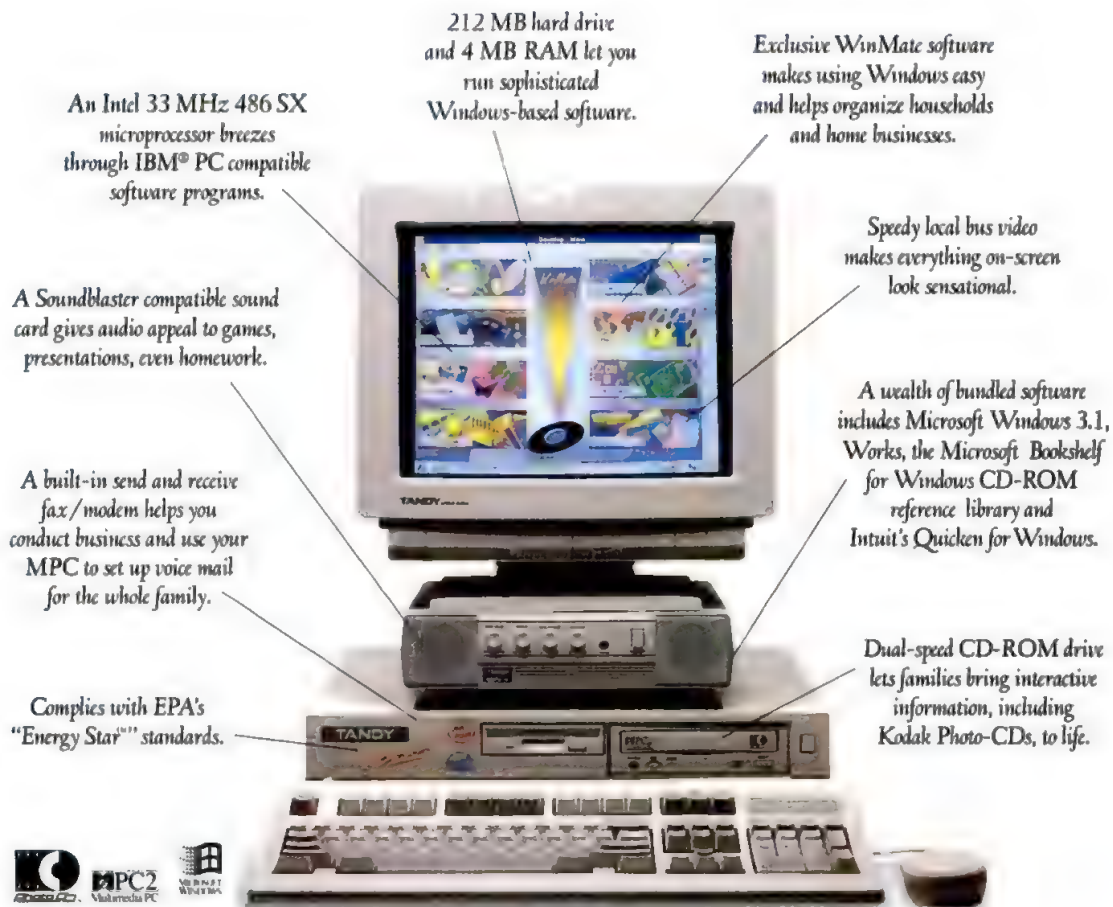
excel in printing dense graphics; details simply don't show up.

The included convertible push and pull tractor can feed continuous forms from the top or bottom of the printer. Single cut sheets load from the top or front, and an optional second pull tractor lets you work interchangeably with push- and pull-feed stock without having to reconfigure the standard tractor.

Two optional cut-sheet bin feeders are also available. The smaller bin feeder (50 sheets) can attach to the high-capacity feeder (150 sheets or 25 envelopes) to make a dual-bin feeder. A nice design touch: DIP (dual in-line package) switches are conveniently located behind a fold-



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Hardware Review,
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down cover on the front panel.

At a street price of around \$235, the ActionPrinter 5000+ and LQ-570+ won't disappoint you. These twins are exceptional for light-to-moderate text-printing applications.

Epson America Inc., 20770 Madrona Ave., Torrance, CA 90509-2842; 800-289-3776, 800-922-8911; fax, 310-782-4248.

EDITORS' CHOICE ▶ **Epson ActionPrinter 5000+** List price: \$349; 32K RAM upgrade, \$152; pull tractor, \$64; 50-sheet feeder, \$73; 150-sheet/25-envelope feeder, \$192; black ribbon, \$7; black single-strike ribbon, \$12; serial interface, \$88. Emulations: *Epson LQ*. Circle 452 on reader service card

Lexmark International Inc.

IBM 2380 Plus

IBM 2390 Plus

BY HAL GLATZER

Lexmark International, appealing to cost-conscious business buyers, offers two narrow-carriage forms printers at reasonable prices. The 9-pin IBM 2380 Plus (\$399) placed well above average on our performance tests, and the 24-pin IBM 2390 Plus (\$429) was distinguished by its exceptionally sharp text and graphics output. Lexmark also produces wide-carriage versions of these two models—the IBM 2381 Plus (\$549) and IBM 2391 Plus (\$599)—but the company was unable to ship them to us in time for testing.

The IBM 2380 Plus and IBM 2390 Plus each have a versatile tractor that can be mounted for either push or pull operation in four configurations. Both models also include bar code fonts and can store up to four user-defined forms macros. The IBM 2380 Plus, which offers Courier and Gothic near-letter-quality fonts, produced solid, well-formed text at an above-average speed. However, graphics output was dark and grainy and showed significant banding.

The IBM 2380 Plus includes some thoughtful touches. The Operator's Panel Lockout feature, for example, disables front-panel controls, except those for feeding and aligning paper. But the printer's user interface is slightly awkward: Labels on the front-panel buttons indicate secondary functions more prominently than primary ones. And the documentation could be better; the instructions never mention, for example, that putting the printer into its quiet mode halves print speed.

For a minimal price increment over the IBM 2380 Plus, the IBM 2390 Plus offers a considerable improvement in print quality. But we must note that our first review unit (part of an early production run) failed during testing; the paper tractor and belt drive stopped short, and the printhead grew so hot that it smoked. Lexmark said it was working on modifications to prevent this problem, and our replacement unit worked flawlessly.

Graphics quality of the IBM 2390 Plus was exceptional for a dot matrix printer—crisp and uniform with good contrast and tonal range. Text quality was equally high. Overall performance, however, was unexceptional. And the IBM 2390 Plus, which offers six internal fonts, shares the documentation and interface idiosyncrasies of the IBM 2380 Plus. We consider these minor nuisances, however. They are hardly significant shortcom-

ings in two otherwise fine machines that will most likely sell on the street for around \$300 each.

Lexmark International Inc., 740 New Circle, Lexington, KY 40511-1847; 800-358-5835, 606-232-2000; fax, 606-232-2380.

IBM 2380 Plus List price: \$399; 150-sheet feeder, \$199; 32K memory upgrade, \$55; black ribbon, \$13.50; serial interface, \$125; acoustic option, \$30. Emulations: *Epson F*; *IBM Proprinter*.

IBM 2390 Plus List price: \$429; 32K memory upgrade, \$79; 150-sheet feeder, \$199; black ribbon, \$13.50; serial interface, \$125; acoustic option, \$30. Emulations: *Epson LQ*; *IBM Proprinter*.

Circle 453 on reader service card

Mannesmann Tally Corp.

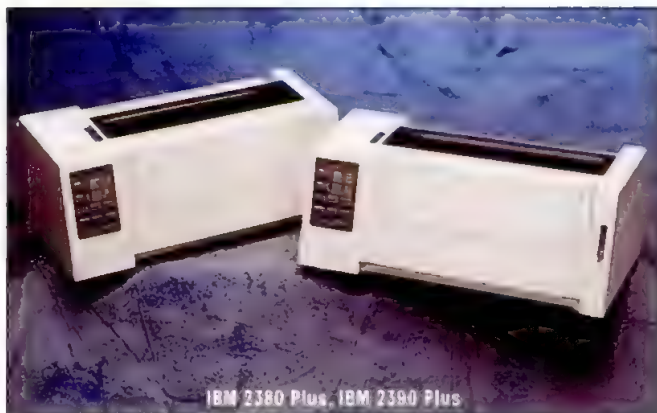
Mannesmann Tally MT360

Mannesmann Tally MT691

BY OLIVER RIST

Mannesmann Tally is known for its high-volume business printers. The two we tested were fine examples, racing past their competition in virtually every performance category. The 24-pin Mannesmann Tally MT360 (\$2,695) is a wide-carriage workhorse with nine internal fonts and auto-switching parallel and serial interfaces. For extremely heavy-duty forms printing, there's the Mannesmann Tally MT691 (\$9,999), a superfast hammer-driven line printer.

The MT360 (about \$2,300 on the street), placed first in nearly all of our 24-pin speed tests. Text was nicely formed in all of its nine internal letter-quality fonts; draft-mode text was dark but slightly



IBM 2380 Plus, IBM 2390 Plus



Mannesmann Tally MT360, Mannesmann Tally MT691

wavy. On our graphics tests, lines were reproduced crisply, but grays were heavily oversaturated.

The MT360's front panel offers a 32-character LCD readout and easy-to-understand font, pitch, and paper controls. The printer's primary paper path for continuous forms is through a bottom-front push tractor; an optional 190-sheet dual bin feeder (\$329) attaches to the top of the printer to provide an almost straight-through path. Other features include zero-tear-off operation and support for Postnet bar code printing. The standard serial and parallel ports support automatic switching, and an optional twinaxial/coaxial network module is available for \$1,200.

If the MT360's rated volume of 22,500 pages per month is more than you need, the company also offers the Mannesmann Tally MT350. At \$2,295 (about \$2,000 on the street), it's slightly less expensive, marginally slower, and rated for only 18,000 pages per month. Because the MT350's construction and features are

dot matrix look; near-letter-quality text was more readable but still only average in clarity. Graphics reproduced poorly, with intermediate gray levels blacked out. The printer includes five fonts and supports Postnet and industrial bar codes.

The MT691 offers only a bottom-feed paper path for continuous-form paper. The standard parallel and serial interfaces support automatic switching, and Mannesmann Tally also offers a \$1,595 twinaxial/coaxial interface module for direct connection to a network. The printer wasn't easy to set up (partly because of its arcane menu structure and partly because the provided documentation was written for the Mannesmann Tally MT661), and Windows drivers were unavailable when we began testing. But if you need this kind of performance, such minor hurdles are justified by the results.

Mannesmann Tally Corp., 8301 S. 180th St., P.O. Box 97018, Kent, WA 98064-9718; 800-843-1347, 206-251-5524; fax, 206-251-5520.

Okidata

Okidata Microline 395
Okidata Microline 395C
Okidata Microline 520
Okidata Microline 521
Okidata Microline 590
Okidata Microline 591

BY OLIVER RIST AND
GREG PASTRICK

Okidata's six new models all have something in common: speed. The narrow-carriage Okidata Microline 520 (\$599) and the wide-carriage Okidata Microline 521 (\$799) were the fastest 9-pin printers in virtually all of our tests. The 24-pin Okidata Microline 590 (\$699) and its wide-carriage incarnation, the Okidata Microline 591 (\$949), turned in above-



virtually identical to those of the MT360, we didn't test it separately.

But we did test the MT691. Unique in this roundup, the MT691 prints a full line of dots at a time, using 132 stationary hammers instead of a movable print-head. This 164-pound behemoth (equipped with casters for easier manipulation) is the embodiment of speed: On our wide-carriage tests, the MT691 delivered 1,049 lines per minute in draft mode and 418 lpm in near-letter-quality mode. The unit (about \$8,000 on the street) is rated for operation at 250,000 pages per month. During testing, draft text output had an angular, distinctively

EDITORS' CHOICE ► Mannesmann Tally MT360 List price: \$2,695; *DEC emulation board*, \$139; *190-sheet dual-bin cut-sheet feeder*, \$329; *black ribbons*, \$27.95 each; *4-color ribbons*, \$49.75 each; *2-color (red and black) ribbons*, \$39.75 each; *twinaxial/coaxial interface module*, \$1,200; *facedown output module*, \$109. Emulations: *Epson LQ, IBM Proprinter*.

Mannesmann Tally MT691 List price: \$9,999; *four black ribbons*, \$225. *twinaxial/coaxial interface module*, \$1,595. Emulations: *DEC LG01, Epson FX, IBM Proprinter, Mannesmann Tally MT360, Printronix P600*.

Circle 454 on reader service card

average performance. And the 24-pin Okidata Microline 395 (\$1,499) and color Okidata Microline 395C (\$1,599) were exceptionally fast at printing text.

Okidata's 500-series models include the patented OkiSmart Paper Handling feature, which automatically moves the printhead to adjust for paper thickness. This feature makes it easy for users to work with forms of differing thicknesses. Okidata also says that this feature optimizes the pins' impact force, reducing mechanical wear and energy consumption.

The 9-pin members of the Okidata family—the Microline 520 and Microline

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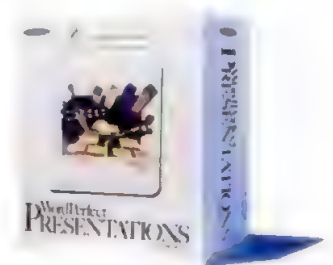
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**PACIFIC DATA
PRODUCTS**

521—are similar units in narrow- and wide-carriage packages. On the street, you can expect to find them for around \$340 and \$999 respectively. Both were exceptional performers on our Text and Graphics Speed tests.

Graphics quality was average with the Microline 520 but poor with the Microline 521, which showed severe banding that resulted in a wavy effect. Text output was more consistent but distinctively 9-pin. In addition to Courier and Gothic fonts, bar code capabilities are built in. The Microline 520 and Microline 521 each offer three standard paper paths (top, rear, and bottom, via a push tractor).

In the middle of Okidata's product line are the Microline 590 and Microline 591, which typically retail for about \$400 and \$540, respectively. Performance for both was well above average, particularly on our graphics tests. Output quality was average, though the Microline 590 had trouble with vertical alignment when printing in bidirectional graphics mode.

These two printers include six internal fonts, bar code capabilities, paper parking, and a quiet mode. Like the Microline 520 and Microline 521, the Microline 590 and Microline 591 each support three paper paths and include an internal push tractor. Both are bundled with a copy of Bitstream's FaceLift for Windows, which includes 15 downloadable Speedo fonts and special-effects capabilities.

At the top end of Okidata's line of dot matrix printers are the 24-pin, wide-carriage Microline 395 and color Microline 395C. Their typical street prices are about \$920 and \$990 respectively. This pair replaces the discontinued Microline 393 series. Like their siblings, the Microline 395 and Microline 395C are fast, placing second and third, respectively, among the 24-pin printers on our Text Speed test. The Microline 395's graphics speed wasn't the best we saw, but it was respectable. Graphics print quality in both monochrome and color was sharp and consistent. But we

found that the 395C's four-color ribbon worked best with solid blocks of color rather than with finely detailed four-color images.

Each of the Microline 395 models include an internal push tractor and built-in Courier, Orator, Roman, Swiss, and bar code fonts. Front panel controls let you adjust buffer size and CPU compensation. All six printers come with OkiSmart Panel software, which lets you control printer settings without leaving your keyboard, and OkiSmart Typer utilities, which let you print labels and access resident bar code fonts.

Okidata, 532 Fellowship Rd., Mt. Laurel, NJ 08054; 800-654-3282, 609-235-2600; fax, 609-778-4184.

Okidata Microline 395 List price: \$1,499; bottom-feed push tractor, \$349; pull tractor, \$79; 170-sheet single-bin feeder, \$399; 170-sheet dual-bin feeder, \$699. Emulations: Epson LQ, IBM Proprinter.

Okidata Microline 395C List price: \$1,599; bottom-feed push tractor, \$349; pull tractor, \$79; 170-sheet single-bin feeder, \$399; 170-sheet dual-bin feeder, \$699. Emulations: Epson LQ, IBM Proprinter.

Okidata Microline 520 List price: \$599; push tractor, \$95; pull tractor, \$55; 170-sheet feeder, \$249. Emulations: Epson FX, IBM Proprinter, Okidata Microline.

Okidata Microline 521 List price: \$799; push tractor, \$99; pull tractor, \$59; 170-sheet feeder, \$279. Emulations: Epson FX, IBM Proprinter, Okidata Microline.

EDITORS' CHOICE ► Okidata Microline 590 List price: \$699; push tractor, \$95; pull tractor, \$55; 170-sheet feeder, \$249; roll-paper stand, \$69; color module, \$74.95; black ribbons, \$13.95 each; color ribbons, \$31.95 each. Emulations: Epson LQ, IBM Proprinter.

EDITORS' CHOICE ► Okidata Microline 591 List price: \$949; push tractor, \$99; pull tractor, \$59; 170-sheet feeder, \$279; color module, \$74.95; black ribbons, \$13.95 each; color ribbons, \$31.95 each. Emulations: Epson LQ, IBM Proprinter. Circle 455 on reader service card

At the top end of Okidata's line are the 24-pin Microline 395 and color Microline 395C. They replace the discontinued Microline 393 series.

Output Technology Corp.

Output Technology EuroLine 800

BY HAL GLATZER

With four printheads, the Output Technology EuroLine 800 (\$8,995) easily topped the speed of the three-head Output Technology EuroLine 600 (\$7,995) that was last year's performance leader and Editors' Choice recipient. The EuroLine 800 is an industrial-strength machine that's as big as a dishwasher. It's able to take in—and stack as output—a 2,000-sheet box of paper. It can handle up to 100-pound stock or six-part forms in widths between 3 and 16 inches.

Despite its imposing profile, the EuroLine 800 is as simple to set up and run as an ordinary dot matrix printer. A schematic tree of every menu function, located alongside the membrane keypad and LCD panel, makes configuration simple. On letter-size paper, the EuroLine 800 uses only the left-most three of its four printheads. Even so, it printed our standard two-page business letter in less than 7 seconds—a speed of 573 lines per minute. Using all four heads, it printed



the wide-carriage version at 611 lpm—impressive speed for a machine that uses movable print elements. By contrast, the Mannesmann Tally MT691 (which scored 1,049 lpm in draft mode) relies on a 132-hammer design that prints a full line of dots at a time.

However, graphics performance was lethargic: It printed our six-font, two-page Microsoft Word for Windows document at a leisurely 32 lpm—considerably slower than the Mannesmann Tally MT691's score of 101 lpm. It also scored lower than the MT691 on our CorelDRAW and Lotus 1-2-3 for Windows tests. Image

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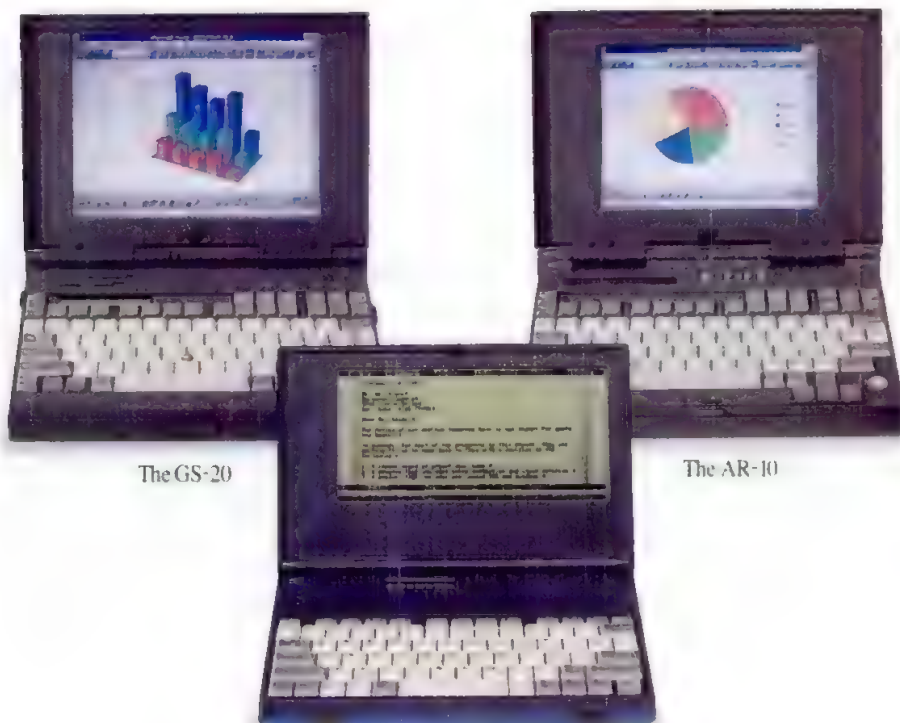
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PRINTERS
Dot Matrix

► **S U M M A R Y O F F E A T U R E S**

Dot Matrix Printers

Products listed in alphabetical order

■ = YES □ = NO

	AMT Accel-212d	AMT Accel-214d	AMT Accel-242d	AMT Accel-244d	AMT Accel-292d	AMT Accel-294d
List price	\$764.00	\$824.00	\$824.00	\$890.00	\$1,090.00	\$1,190.00
Physical Characteristics						
Dimensions (HWD, in inches)	9.8 x 16.5 x 14.4	9.8 x 21.4 x 14.4	9.8 x 16.5 x 14.4	9.8 x 21.4 x 14.4	9.8 x 16.5 x 14.4	9.8 x 21.4 x 14.4
Weight (pounds)	24	31	25	32	25	32
Carriage size	Narrow	Wide	Narrow	Wide	Narrow	Wide
Number of pins or hammers	9	9	24	24	9 (dual-head)	9 (dual-head)
Maximum resolution (dpi)	240 x 216	240 x 216	360 x 360	360 x 360	240 x 216	240 x 216
Color capability	□	□	□	□	□	□
Memory	8K	8K	8K	8K	8K	8K
Parallel/serial interface	■ □	■ □	■ □	■ □	■ □	■ □
Printer-specific Microsoft Windows 3.1 driver available	□	□	□	□	□	□
Paper Handling						
Rated maximum paper weight (pounds)	70	70	70	70	70	70
Paper feeds:						
Pressure	■	■	■	■	■	■
Internal push tractor	■	■	■	■	■	■
Internal pull tractor	■	■	■	■	■	■
External push tractor	□	□	□	□	□	□
External pull tractor	□	□	□	□	□	□
Paper paths	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear U
Tear-off space (inches)	None	None	None	None	None	None
Resident Typefaces						
Courier	□	□	■	■	□	□
Gothic	□	□	□	□	□	□
Line printer	■	■	■	■	■	■
OCR-A/OCR-B	□ □	□ □	□ ■	□ ■	□ □	□ □
Orator	□	□	■	■	□	□
Prestige Elite	□	□	■	■	□	□
Sans Serif	■	■	■	■	■	■
Script	□	□	□	□	□	□
Times Roman	■	■	■	■	■	■
Number of scalable fonts	None	None	None	None	None	None
Postnet bar codes	Optional	Optional	Optional	Optional	Optional	Optional
Rated Noise Level						
Standard mode, quiet mode (dB)	55, N/A	55, N/A	55, 53	55, 53	57, N/A	57, N/A
Control Panel						
Number of LCD characters	16	16	16	16	16	16
Buttons:						
Emulations	■	■	■	■	■	■
Form-feed and line-feed	■	■	■	■	■	■
Paper parking	□	□	□	□	□	□
Print mode	■	■	■	■	■	■
Typeface selection	■	■	■	■	■	■
Customer Support						
Toll-free technical support	■	■	■	■	■	■
Telephone support hours (eastern time)	9:00-8:00 M-F	9:00-8:00 M-F	9:00-8:00 M-F	9:00-8:00 M-F	9:00-8:00 M-F	9:00-8:00 M-F
BBS	□	□	□	□	□	□
Warranty	1 year	1 year	1 year	1 year	1 year	1 year

N/A—Not applicable. The product does not have this feature.

PRINTERS
Dot Matrix

CONTINUES



AMT cal-535d	Citizen GSX-190	Citizen GSX-230	Datasouth Documax A3302	DECwriter 95	Digital LA310 MultiPrinter	Epson ActionPrinter 5000+	Lexmark IBM 2380 Plus	Lexmark IBM 2390 Plus
\$2,095.00	\$199.00	\$299.00	\$2,195.00	\$319.00	\$599.00	\$349.00	\$399.00	\$429.00
24 x 19	5.4 x 17 x 12.8	5.4 x 17 x 12.6	12.3 x 17 x 15.7	5.4 x 15.9 x 12.6	4.3 x 23.8 x 15	6.5 x 17.3 x 14.3	7.5 x 19.5 x 11.3	7.5 x 19.5 x 11.3
58	12	12	45	12	22	15	15	15
Wide	Narrow	Narrow	Narrow	Narrow	Wide	Narrow	Narrow	Narrow
24	9	24	9	24	9	24	9	24
80 x 240	240 x 216	360 x 360	240 x 217	360 x 360	240 x 144	360 x 360	240 x 144	360 x 360
■	Optional	Optional	□	Optional	□	□	□	□
64K	8K	8K	3K	8K	32K	8K	11K	32K
■ ■	■ Optional	■ Optional	■ ■	■ Optional	■ ■	■ Optional	■ Optional	■ Optional
request)	(via BBS)	(via BBS)	□	(included)	(via BBS)	(in Windows)	(via BBS)	(via BBS)
70	27	27	Info not available	27	24	24	24	24
■	■	■	□	■	■	■	■	■
■	■	■	■	■	■	■	■	■
□	■	■	□	■	□	■	■	■
□	□	□	□	□	□	□	□	□
Optional	□	□	□	□	Optional	□	□	□
Bottom vertical, rear U, top U	Bottom vertical, rear L, rear U	Bottom vertical, rear L, rear U	Two bottom vertical	Bottom vertical, front L, rear L, rear U	Rear U	Bottom vertical, front L, rear U	Bottom vertical, front L, front S, rear L, rear U	Bottom vertical, front L, front S, rear L, rear U
None	None	None	None	None	None	0.3	None	None
■	■	■	■	■	■	■	■	■
■	□	□	□	□	□	□	■	■
■	□	□	■	■	■	■	□	□
□ □	□ □	□ □	■ ■	□ ■	□ □	□ ■	□ □	□ □
□	■	■	□	■	□	■	□	■
■	■	■	■	■	□	■	□	■
□	■	■	□	■	□	■	□	■
□	■	■	□	■	□	■	□	□
□	□	□	□	■	□	■	□	□
None	None	None	None	2	None	4	None	None
Optional	□	□	□	□	□	□	■	■
55, N/A	48, 45	47, 43	57, N/A	46, 43	55, 53	47, N/A	55, 54	55, 54
16	N/A	N/A	16	9	N/A	N/A	N/A	N/A
■	■	■	■	■	■	□	□	□
■	□	□	■	□	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	■	■	■	■	■	■	■	■
■	□	□	■	■	■	■	Dealer option	Dealer option
0-8:00 M-F	11:00-7:00 M-F	11:00-7:00 M-F	8:30-7:00 M-F	8:30-8:00 M-F	8:30-8:00 M-F	9:00-9:00 M-F	Dealer option	Dealer option
□	■	■	□	□	■	■	■	■
1 year	2 years	2 years	1 year	2 years	1 year	2 years	2 years	2 years

PRINTERS
Dot Matrix

► **S U M M A R Y O F F E A T U R E S**

Products listed in alphabetical order

■ = YES □ = NO



	Mannesmann Tally MT360	Mannesmann Tally MT691	Okidata Microline 395	Okidata Microline 395C	Okidata Microline 520	Okidata Microline 521
List price	\$2,695.00	\$9,999.00	\$1,499.00	\$1,599.00	\$599.00	\$799.00
Physical Characteristics						
Dimensions (HWD, in inches)	10.5 x 24.5 x 15.5	44 x 31.4 x 22	7.3 x 21.3 x 17	7.3 x 21.3 x 17	6.5 x 17 x 15	6.5 x 23 x 15
Weight (pounds)	44	164	47	47	17	23
Carnage size	Wide	Wide	Wide	Wide	Narrow	Wide
Number of pins or hammers	24	132	24	24	9	9
Maximum resolution (dpi)	360 x 360	240 x 240	360 x 360	360 x 360	144 x 288	144 x 288
Color capability	□	□	□	■	□	□
Memory	128K	8K	64K	64K	64K	64K
Parallel/serial interface	■ ■	■ ■	■ ■	■ ■	■ Optional	■ Optional
Printer-specific Microsoft Windows 3.1 driver available	□	□	■ (when registering or via BBS)	■ (when registering or via BBS)	■ (included)	■ (included)
Paper Handling						
Rated maximum paper weight (pounds)	24	24	24	24	24	24
Paper feeds						
Pressure	■	□	■	■	■	■
Internal push tractor	■	■	■	■	■	■
Internal pull tractor	Optional	■	Optional	Optional	Optional	Optional
External push tractor	□	□	Optional	Optional	Optional	Optional
External pull tractor	□	□	□	□	Optional	Optional
Paper paths	Bottom vertical, front L	Bottom vertical	Bottom vertical, rear U	Bottom vertical, rear U	Bottom vertical, rear L, rear U	Bottom vertical, rear L, rear U
Tear-off space (inches)	None	N/A	1	1	None	None
Resident Typefaces						
Courier	■	■	■	■	■	■
Gothic	■	■	□	□	■	■
Line printer	□	■	□	□	□	□
OCR-A/OCR-B	■ ■	■ ■	□ □	□ □	□ □	□ □
Orator	□	□	■	■	□	□
Prestige Elite	■	□	□	□	□	□
Sans Serif	■	□	■	■	□	□
Script	■	□	□	□	□	□
Times Roman	■	□	■	■	□	□
Number of scalable fonts	None	None	None	None	None	None
Postnet bar codes	■	■	■	■	■	■
Rated Noise Level						
Standard mode, quiet mode (dB)	55, N/A	55, N/A	58, 54	58, 54	55, 53	55, 53
Control Panel						
Number of LCD characters	32	16	N/A	N/A	N/A	N/A
Buttons						
Emulations	■	■	■	■	■	■
Form-feed and line-feed	■	■	■	■	■	■
Paper parking	□	□	■	■	■	■
Print mode	■	■	■	■	■	■
Typeface selection	■	■	■	■	■	■
Customer Support						
Toll-free technical support	■	■	■	■	■	■
Telephone support hours (eastern time)	4:30 A.M. – 1:30 P.M. M–F	4:30 A.M. – 1:30 P.M. M–F	8:00–6:00 M–F	8:00–6:00 M–F	8:00–6:00 M–F	8:00–6:00 M–F
BBS	■	■	■	■	■	■
Warranty	1 year	2 years	1 year	1 year	1 year	1 year

N/A—Not applicable. The product does not have this feature.

PRINTERS
Dot Matrix

CONTINUES

PC MAGAZINE
EDITORIAL CHOICE

Okidata Line 590	Okidata Microline 591	Output Technology EuroLine 800	Panasonic KX-P2023	Panasonic KX-P2124	Panasonic KX-P3123	Panasonic KX-P3124	Panasonic KX-P3624	Seikosha SL-70
\$900	\$949.00	\$8,995.00	\$249.95	369.95	\$369.95	\$449.95	\$519.95	\$499.00
17 x 15	6.5 x 23 x 15	42.9 x 27 x 32.4	5.3 x 17.1 x 12.4	6.3 x 19 x 15.4	5.8 x 18.1 x 14.3	6.3 x 19 x 15.4	6.8 x 23.2 x 15.7	4.8 x 15 x 11
17	20	180	11	19	19	19	34	8
Row	Wide	Wide	Narrow	Narrow	Narrow	Narrow	Wide	Narrow
24	24	21 (quad-head)	24	24	24	24	24	24
x 360	360 x 360	240 x 144	360 x 360	360 x 360	360 x 360	360 x 360	360 x 360	360 x 360
Optional	Optional			Optional	Optional	Optional		
64K	64K	8K	14K	20K	46K	52K	58K	5K
Optional	Optional	Optional		Optional	Optional	Optional	Optional	
(included)	(included)	(via BBS)	(included)	(included)	(included)	(included)	(included)	
24	24	100	24	24	24	24	24	21
Optional	Optional							
Optional	Optional							
Optional	Optional							
Bottom vertical, rear U	Bottom vertical, rear L, rear U	Bottom vertical, front L, front S, rear L, rear U	Rear U	Bottom vertical, front L, rear U	Bottom vertical, rear U	Bottom vertical, front L, rear U	Bottom vertical, front L, rear U	Rear U
None	None	N/A	03	06	06	06	06	1
None	None	None	None	None	4	6	6	None
7, 53	57, 53	53, 48	47, 44	47, 44	47, 44	47, 44	47, 44	57, 54
N/A	N/A	32	N/A	16	N/A	16	16	N/A
6:00 M-F	8:00-6:00 M-F	9:00-7:00 M-F	9:00-7:00 M-F	9:00-7:30 M-F	9:00-7:00 M-F	9:00-7:00 M-F	9:00-7:00 M-F	9:00-5:00 M-F
1 year	1 year	1 year (parts only)	2 years	2 years	2 years	2 years	2 years	2 years

► **S U M M A R Y O F F E A T U R E S**

ENDS

Products listed in alphabetical order

■ = YES □ = NO

	Seikosha SL-75	Seikosha SP-2450	Tandy DMP 137	Tandy DMP 203	Tandy DMP 250
List price	\$549.00	\$399.00	\$249.99	\$269.99	\$399.99
Physical Characteristics					
Dimensions (HWD, in inches)	5.5 x 15.5 x 12.3	4.8 x 15 x 11	5.5 x 15.7 x 12.5	4.7 x 15.5 x 11.5	5.4 x 15 x 11.5
Weight (pounds)	10	10	9	8	11
Carriage size	Narrow	Narrow	Narrow	Narrow	Narrow
Number of pins or hammers	24	9	9	24	24
Maximum resolution (dpi)	360 x 360	240 x 216	240 x 216	360 x 180	360 x 360
Color capability	□	□	□	□	□
Memory	43K	32K	1K	12K	8K
Parallel/serial interface	■ □	■ □	■ □	■ □	■ □
Printer-specific Microsoft Windows 3.1 driver available	□	□	□	□	□
Paper Handling					
Rated maximum paper weight (pounds)	21	20	20	20	27
Paper feeds:					
Pressure	■	■	■	■	■
Internal push tractor	■	■	■	■	■
Internal pull tractor	□	□	□	□	■
External push tractor	□	□	□	□	□
External pull tractor	□	□	□	□	□
Paper paths	Rear U	Rear U	Rear U	Rear U	Bottom vertical, rear U
Tear-off space (inches)	1	1	None	None	None
Resident Typefaces					
Courier	■	■	■	■	■
Gothic	■	■	■	□	□
Line printer	□	□	□	□	□
OCR-A/OCR-B	■ ■	□ □	□ □	□ □	□ ■
Orator	■	□	□	□	■
Prestige Elite	■	■	■	□	■
Sans Serif	■	■	■	□	■
Script	■	□	□	□	■
Times Roman	■	□	□	□	■
Number of scalable fonts	None	None	None	None	2
Postnet bar codes	□	□	□	□	□
Rated Noise Level					
Standard mode, quiet mode (dB)	57, 54	57, 54	Info not available	Info not available	46, 43
Control Panel					
Number of LCD characters	N/A	N/A	N/A	N/A	9
Buttons:					
Emulations	□	□	□	□	■
Form-feed and line-feed	■	■	□	□	□
Paper parking	■	■	■	□	■
Print mode	■	■	■	■	■
Typeface selection	■	■	■	□	■
Customer Support					
Toll-free technical support	■	■	□	□	□
Telephone support hours (eastern time)	9:00-5:00 M-F	9:00-5:00 M-F	None	None	None
BBS	■	■	□	□	□
Warranty	2 years	2 years	1 year	1 year	1 year

N/A—Not applicable: The product does not have this feature

New OCR technology in XIS's \$99 TextBridge

Neural networks, morphology, lexical analysis used in product from PARC

Xerox Imaging Systems has developed a new OCR program for Windows, called TextBridge, that features improved accuracy for fax and degraded documents. It cost only \$99.

Designed by XIS with some help from the folks at Xerox PARC, TextBridge is aimed at everyday users who v... Documents, such

Xerox's \$99 Windows Package With OCR

One of the latest entries into the ever-widening Windows application arena is a \$99 OCR (optical character recognition) package that includes advanced artificial intelligence technology developed at Xerox's renowned Palo Alto Research Center (PARC).

The first Windows version of TextBridge adds a "lexer," improved "automatic segmentation," and other

Xerox Imaging's TextBridge lowers OCR price point to \$99.

To vie for a piece of the competitive optical character recognition software market, Xerox Imaging Systems Inc. is attempting to lower the entry point with a new \$99 package.

TextBridge leverages technology from parent company Xerox Corp.'s Palo Alto Research Center to provide OCR capabilities on par with products priced above \$295, said officials at the Peabody, Mass., firm.

PC WEEK • JUNE 21, 1993

Other OCR products may be able to read this. But none of them can say it.

Introducing TextBridge™. The new Optical Character Recognition (OCR) software for Windows™ from Xerox

**"It's easy to use.
It's accurate and
it's cheap."**

Imaging Magazine 6/93

Imaging Systems. With a low \$99 price and a high accuracy rate, TextBridge sets a new standard for

OCR software.

Most everyone agrees that OCR has always been

a good value because it lets you convert printed documents to electronic text effortlessly. Accurately. And once converted, you can edit the text, store it, search it or distribute it. But now, with TextBridge, price isn't

**"Xerox integrates
OCR innovations into
\$99 package...about one-fourth the cost of existing
OCR programs."**

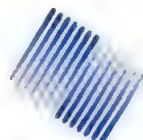
InfoWorld 6/93

a barrier even for those with just an occasional need for OCR.

Order TextBridge now so your PC can give old documents new life electronically. Even degraded

documents like faxes and photocopies can be accurately recognized. Call **1-800-248-6550**, ext. 3, to try TextBridge for 30 days. If you're not satisfied, we'll refund your money — no questions asked. At only \$99, TextBridge OCR software reads your budget loud and clear.

**A special offer
is in effect for fax
modem users. Call
1-800-248-6550
today for details.**



Xerox Imaging Systems
A Xerox Company

CIRCLE 078 ON READER SERVICE CARD

quality was low, with severe jaggies and poor alignment on vertical boundaries.

Clearly, this isn't a printer for every task (or every budget; it typically sells for around \$6,300). But for pumping out reams of wide-carriage, multipart forms, the EuroLine 800 may be right for the job.

Output Technology Corp., 2310 N. Fancher Rd., Spokane, WA 99212-1381; 509-536-0468; fax: 509-533-1280.

OTC EuroLine 800 List price: \$8,995; OCR-A and OCR-B font cartridges, \$199.95 for pair; two black ribbons, \$74.80; acoustic hood, \$895. Emulations: Dataproducts LB, DEC LA 210, Epson FX, IBM Proprinter, Printronix 6080. Circle 456 on reader service card

Panasonic Communications & Systems Co.

Panasonic KX-P2023

Panasonic KX-P2124

Panasonic KX-P3123

Panasonic KX-P3124

Panasonic KX-P3624

BY STEPHEN W. PLAIN

Plenty of printers offer quiet modes that reduce noise (albeit at the expense of speed), but Panasonic touts this feature like no other company. The Panasonic KX-P2023 (\$249.95), Panasonic KX-P3123 (\$369.95), Panasonic KX-P3124 (\$449.95), and wide-carriage Panasonic KX-P3624 (\$519.95) are all 24-pin units capable of firing their pins sequentially rather than simultaneously to achieve quieter operation. The KX-P2000 line, which also includes the \$369.95 Panasonic KX-P2124 (an Editors' Choice recipient last year), is targeted toward personal and small-office use. The KX-P3000 models, which include internal scalable fonts, are geared toward systems integrators, value-added resellers, and government users. But the bargain-priced KX-P2023 is the best value among these five.

The KX-P2023, with an internal push tractor and four letter-quality fonts, typically sells for under \$200. Befitting its price, both text and graphics output speeds were below average on our tests.



Text was rendered with high quality, but graphics were only average, displaying some banding.

The KX-P2124 is still quick, but it doesn't compare well with this year's tougher competition. Its \$300 street price is as high as that of the more-capable KX-P3123. The KX-P2124 includes a push and pull tractor and eight bitmapped letter-quality fonts, which were crisply formed but prone to dropouts. Graphics output was detailed and well balanced but slightly oversaturated.

The three KX-P3000 models include internal scalable fonts, which can be sized from 8 to 96 points in both DOS and Windows. Each unit is also bundled with Adobe Type Manager. Internal push and pull tractors are standard.

The least expensive of these three models, the KX-P3123 (which sells for about \$300 on the street) comes with six letter-quality fonts, four of them scalable.

It also offers a super-letter-quality Roman font (printed in a 30-by-48 dot matrix, which compares with 30-by-24 dot matrix for standard quality mode). The KX-P3123 can be upgraded to support color, but its monochrome graphics output was only fair on our tests, tending to be washed-out and marred by banding. The KX-P3123's performance was average on our Graphics Speed test but well below average for text output.

The KX-P3124 is a step up from the

KX-P3123, offering eight letter-quality fonts (six scalable), as well as super-letter-quality Roman. Its configuration is made easier by a 16-character LCD control panel. The KX-P3124 (about \$350 on the street) was an average performer. Images were reproduced inconsistently, with both light and dark streaks evident.

The KX-P3624 wide-carriage model offers the same internal fonts and LCD-panel configuration as the KX-P3124. However, the KX-P3624, which should sell for around \$400, was the slowest 24-pin printer on our wide-carriage Text Speed test in draft mode. Performance was average on our narrow-carriage, letter-quality, and Windows applications

tests. The KX-P3124's output was extremely dark, which made for high-contrast text but obscured detail in images.

The KX-P3000 models we saw were prone to overheating. After a couple of pages of dense graphics, they displayed a

message reading "Printhead Hot," exercised the printhead by moving it back and forth until it cooled, and resumed printing. Panasonic said the models we tested were part of the first production lot; it plans appropriate modifications to prevent this problem.

While the KX-P2023 is a fair buy, the KX-P2124 is beginning to show its age. And with their slow speed and overheating problems, the KX-P3000 models we tested didn't stand out.

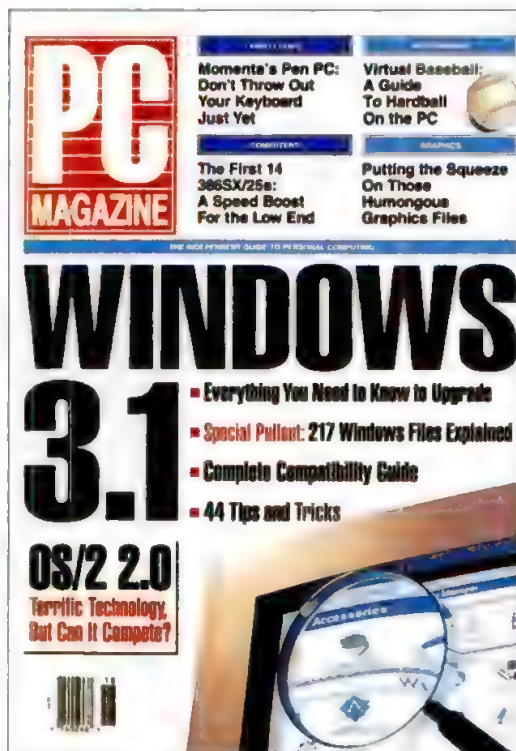
*The least expensive of the
KX-P3000 line, the
Panasonic KX-P3123
comes with six letter-quality
fonts, four of them scalable.*

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Panasonic Communications & Systems Co., Two Panasonic Way, Secaucus, NJ 07094; 800-742-8086, 201-348-7000.

Panasonic KX-P2023 List price: \$249.95; 32K memory upgrade, \$39.95; 80-sheet feeder, \$69.95; black ribbons, \$12.99 each. Emulations: Epson LQ, IBM Proprinter.

Panasonic KX-P2124 List price: \$369.95; 32K memory upgrade, \$75; 100-sheet feeder, \$149.95; color kit, \$69.95; black ribbons, \$12.99 each; color ribbons, \$24.99 each; serial interface, \$69.95 (9,600 bps) or \$109.95 (19.2 Kbps). Emulations: Epson LQ, IBM Proprinter.

Panasonic KX-P3123 List price: \$369.95; 80-sheet feeder, \$139.95; color kit, \$69.95; black ribbons, \$12.99 each; color ribbons, \$24.99 each; serial interface, \$69.95 (9,600 bps) or \$109.95 (19.2 Kbps). Emulations: Epson LQ, IBM Proprinter.

Panasonic KX-P3124 List price: \$449.95; color kit, \$69.95; black ribbons, \$12.99 each; color ribbons, \$24.99 each; serial interface, \$69.95 (9,600 bps) or \$109.95 (19.2 Kbps). Emulations: Epson LQ, IBM Proprinter.

Panasonic KX-P3624 List price: \$519.95; 100-sheet feeder, \$239.95; black ribbons, \$12.99 each; serial interface, \$69.95 (9,600 bps) or \$109.95 (19.2 Kbps). Emulations: Epson LQ, IBM Proprinter. Circle 457 on reader service card

Seikosha America Inc.

Seikosha SL-70

Seikosha SL-75

Seikosha SP-2450

Tandy/Radio Shack Corp.

Tandy DMP 137

BY GREG PASTRICK AND

JOSEPH DESPOSITO

The performance, functionality, and features of Seikosha America's three new dot matrix printers and a sibling from Tandy/Radio Shack Corp. all come in at the low end of our lineup. The 24-pin, narrow-carriage Seikosha SL-70 lists for \$499. The Seikosha SL-75 (\$549) is a similar

model with color capability. The 9-pin, narrow-carriage Seikosha SP-2450 (\$399) also offers color. A variant of the Seikosha SP-2450 is sold as the Tandy DMP 137 (\$249.99). You may find the Seikosha printers for as much as 40 percent below their list prices. However, Tandy rarely discounts the price of the Tandy DMP 137.



The trim, lightweight Seikosha SL-70 and Seikosha SL-75 offer a wide selection of internal letter-quality fonts; Courier, Gothic, Helvetica, OCR-A, OCR-B, Orator, Prestige Elite, Roman, Sans Serif, and Script are all built in. But these printers were consistently slower than average among the 24-pin printers we tested. Graphics performance was lackluster, and graphics print quality was average—with good contrast but some streaking and banding.

The 9-pin Seikosha SP-2450 and derivative Tandy DMP 137 produced nicely formed, highly readable text. They offer four built-in fonts—Courier, Gothic, Prestige Elite, and Sans Serif—but switching among them is a hassle. You have to use the control panel to position the printhead under font names embossed on the clear plastic cover of the machine. A similar procedure applies to selecting character pitch, margins, and high-speed or super-high-speed draft modes. The Seikosha SP-2450 and Tandy DMP 137 were the two slowest 9-pin printers at standard speed, and both placed near the bottom on our Windows applications tests. Graphics showed good contrast but some banding.

All four models come with internal push tractors. The Seikosha SP-2450 had recurrent problems with paper jams during testing. Feeding single sheets was straightforward, but a cut-sheet feeder isn't available.

Given their mediocre performance, inconvenient print controls, and limited paper-handling options, these four printers barely justify their price tags.

Seikosha America Inc., 10 Industrial Ave., Mahwah, NJ 07430; 800-338-2609, 201-327-7227; fax, 201-818-9135.

Seikosha SL-70 List price: \$499; 100-

sheet feeder, \$169; black ribbons, \$9.95 each. Emulations: Epson LQ.

Seikosha SL-75 List price: \$549; 100-sheet feeder, \$169; black ribbons, \$9.95 each; color ribbons, \$12.50 each. Emulations: Epson LQ.

Seikosha SP-2450 List price: \$399; black ribbons, \$9.95 each; color ribbons, \$12.50 each. Emulations: Epson EX, Epson FX, IBM Proprinter.

Circle 458 on reader service card

Tandy/Radio Shack Corp., 1500 One Tandy Center, Fort Worth, TX 76102; 817-390-3011.

Tandy DMP 137 List price: \$249.99; black ribbons, \$13.99 each; color ribbons, \$29.99 each. Emulations: Epson EX, Epson FX, IBM Graphics Printer, IBM Proprinter, Tandy 136/137.

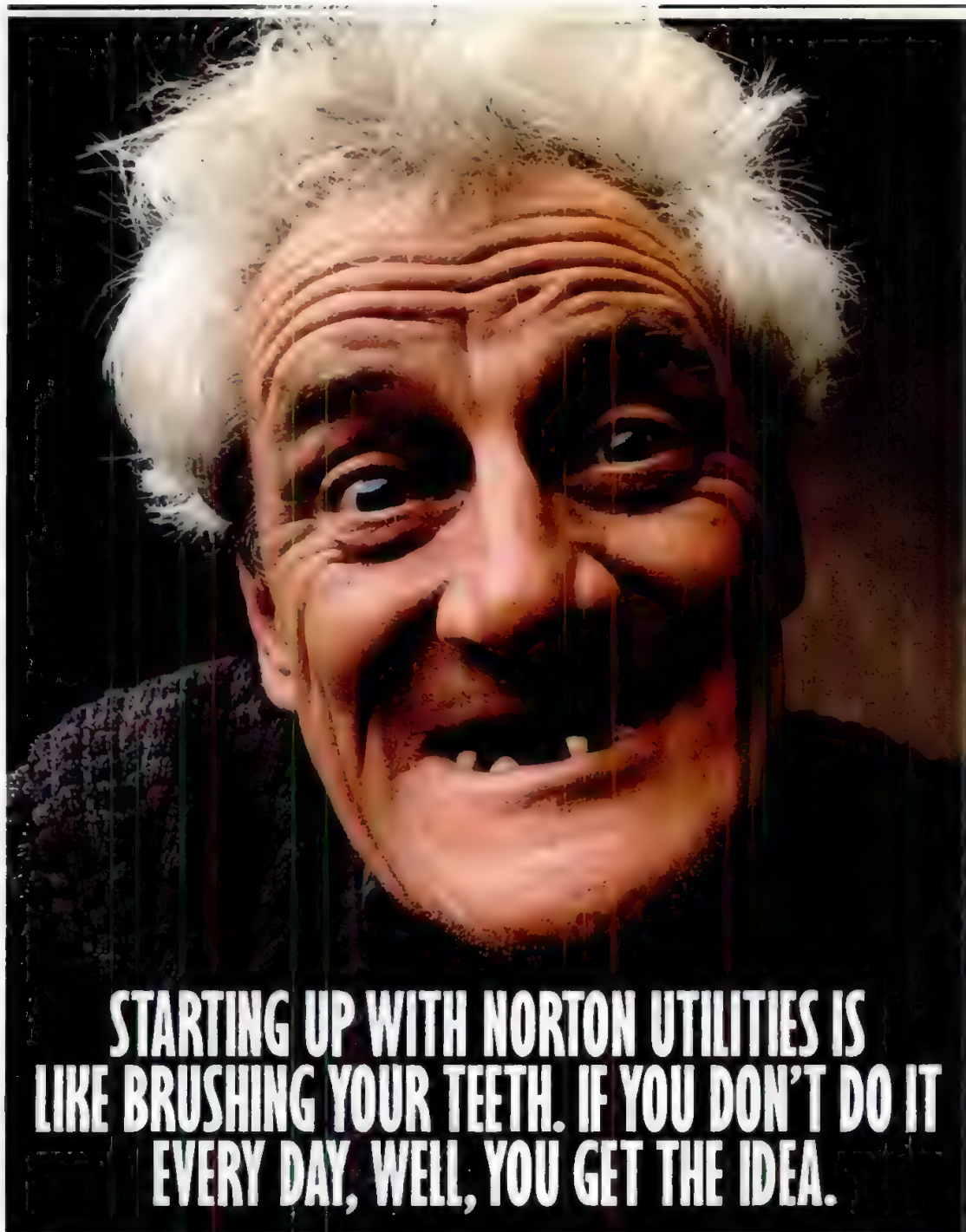
Circle 459 on reader service card

Tandy/Radio Shack Corp.

Tandy DMP 203

BY JOSEPH DESPOSITO

The 24-pin Tandy DMP 203 doesn't offer many features and is therefore a cinch to use. The DMP 203 replaces the Tandy DMP 202 (reviewed in our 1991 printer issue) and is nearly twice as fast as its ancestor in letter-quality mode. And at its suggested retail price of \$269.99, it sells for \$130 less. We also tested two other



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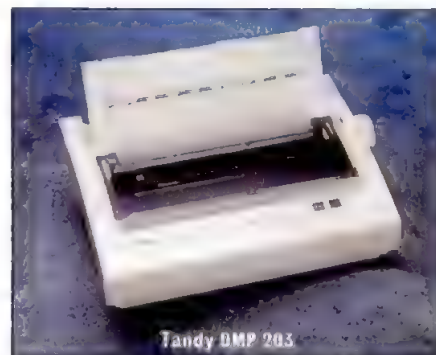
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PRINTERS *Dot Matrix*

Tandy dot matrix printers this year: the Tandy DMP 137 (reviewed with its twin, the Seikosha SP-2450) and the Tandy DMP 250 (manufactured by Citizen and reviewed with the Citizen GSX-190, Citizen GSX-230, and DECwriter 95).

The narrow-carriage DMP 203 offers good text quality in its only letter-quality typeface, Courier. Graphics quality was fair, with good contrast and tonal range. However, some overlap was evident



between successive passes of the printhead.

The DMP 203 is easy to operate: You switch into letter-quality, draft, or super-speed draft mode by pressing one of only two membrane switches that constitute the control panel. (The other is used to advance paper.) A light-emitting diode flashes once, twice, or three times to indicate modes. The printer has a built-in push tractor for fanfold paper, and an included paper rack lets you feed single sheets. A paper-bail lever loads either type of paper automatically, but paper parking is a manual process.

Performance figures placed the unit near the middle of the tested 24-pin printers for letter-quality printing but next to last for draft text. It scored last on our Graphics Speed test but came closer to average on our Windows applications tests.

You won't find a discounted price on the DMP 203, which is sold through Tandy's extensive chain of retail outlets. If its basic features are sufficient, though, you should be pleased with its easy operation and good output. □

Tandy/Radio Shack Corp., 1500 One Tandy Center, Fort Worth, TX 76102; 817-390-3011.

Tandy DMP 203 List price: \$269.99; black ribbons, \$13.99 each. Emulations: IBM Graphics Printer, IBM Proprinter, Tandy DMP 202.

Circle 459 on reader service card

Network Edition

THE LATEST NETWORK PRODUCTS AND MANAGEMENT TECHNIQUES

FIRST LOOKS

HANDS-ON EVALUATIONS OF THE NEWEST NETWORK PRODUCTS

◀ NETWORK MANAGEMENT

IBM's NetVIEW/6000 Challenges the Best

BY JEFFREY D. BAHER

Watch out, SunNet Manager and HP OpenView: Version 2 of IBM's AIX SystemView NetVIEW/6000 is looking to steal the SNMP-based network management throne. It runs on IBM's high-performance RISC System/6000 PowerStation or PowerServer and is designed for its functionality. HP OpenView, on the other hand, is intended for off-the-shelf, plug-and-play network management. It

based network management platform. Prior to IBM's entrance onto the SNMP management.

breeze but also greatly facilitates network makes navigating through your network an exceptional interface that not only interface (GUI). NetVIEW/6000 delivers Foundation (OSF)/Motif graphical user OpenView. Based on an Open Systems Manager and Hewlett-Packard's HP devices just like SunConnect's SunNet to manage all IP-addressable SNMP Station or PowerServer and is designed performance RISC System/6000 Power-

First Looks

NetView 6000	NE1
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▶ NETWORK EDITION INDEX

The four principle components of the NetVIEW/6000 interface are Topology Display, Navigation Tree, Tool Palette, and Control Desk. At start-up, NetVIEW/6000 executes an auto-discovery of IP-addressable devices on the network. When the discovery is complete, an icon representing the entire network will appear in the Topology Display. Double-clicking on the network icon generates sub-map views. From the Topology

NetVIEW/6000's overall functionality. available for the platform, a fact that limits use, although to date, fewer applications are NetVIEW/6000 is intended for off-the-shelf for NetVIEW/6000. Like OpenView, code as the primary building block HP. In fact, IBM uses HP OpenView's IBM takes a similar approach to that of off-the-shelf network management a reality. Information Base (MIB) Browser to make but tools such as the Management offers not only a more user-friendly GUI,

Continues on page NE4

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IBM NetVIEW/6000

CONTINUED FROM PAGE NE1

Display, the network manager can navigate up and down the network hierarchy.

A variety of tools are available for customizing network maps, including a wide range of icons and colors to depict network devices. Also, in order to provide an accurate geographic display, NetVIEW/6000 offers background pictures including a litany of countries and states in which to place network views. In all, the Topology Display is a clean and simple way of viewing the layout of your network devices. NetVIEW/6000 even allows for multiple open Topology Display windows, enabling you to view different parts of your network simultaneously.

As the network manager travels through the network, the Navigation Tree keeps track of the network maps that are viewed. Every time a user double-clicks on a segment in the Topology Display, the Navigation Tree shows where the user is in relation to the rest of the network. The

Navigation Tree also grants the user the ability to open additional Topology Displays.

While the Topology Display and the Navigation Tree provide graphical map views of the network, the Control Desk and the Tool Palette provide the management tools. The Control Desk serves as a workspace to group and run applications.

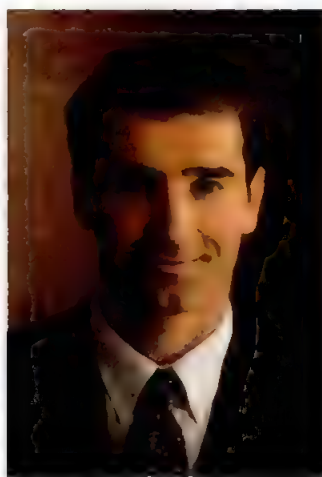
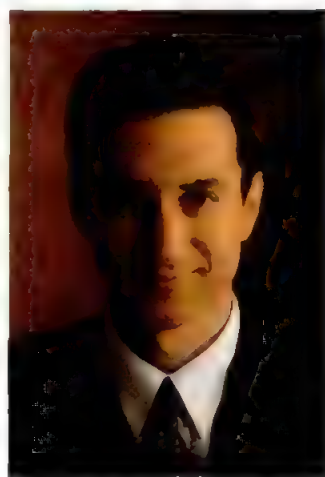
The Events application is started by default in the Control Desk and displays network events and traps. Like HP OpenView, the Events application displays events in list form. However, NetVIEW/6000 also allows the user to display events in card form. Each new event is represented by an index card stacked on top of the preceding event's card. Event cards can be labeled or sorted in a variety of ways to better manage network events. The user can also attach a note to the event card, quickly locate the device on the Topology Map, or access the MIB Browser to query the device.

The Tool Palette serves as a holding place for commonly used tools and applications. NetVIEW/6000 comes standard

with 11 tools, including monitor tools for SNMP and interface traffic. To monitor SNMP traffic, for example, simply highlight a node in the Topology Map, click on the appropriate tool in the Tool Palette and drag it over to the Control Desk. The Events list will go to the background while a graph appears plotting SNMP traffic for that node. At any point, the user can toggle back to the Events application or any other application that is currently in use in the Control Desk.

NetVIEW/6000 also offers other functions to facilitate network management. First and foremost is the MIB Browser, a tool that NetVIEW/6000 borrowed from HP OpenView. The MIB Browser is designed to provide quick access to MIB values for SNMP agents on the network. From the MIB Browser, locating specific MIB variables and executing MIB queries is a simple process. Since MIBs contain pertinent information to help monitor and manage SNMP devices, the convenience and simplicity of the MIB Browser

Continues on page NE6



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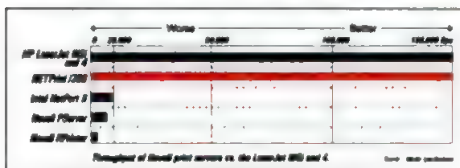
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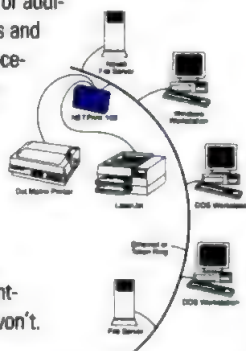
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Model	Network Capabilities	Network Operating System	Printer Connections (Maximum or optional)	Memory	Price
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NETPrint 100	Ethernet 10BaseT and BMC 4/10MB Token Ring (DS and S/40)	Single Novell	2 parallel 1-8MB Upport	\$12K ROM \$12K RAM	\$126 (E) \$126 (T)
NETPrint 200	Ethernet 10BaseT and BMC 4/10MB Token Ring (DS and S/40)	Multiple Novell Apple	2 parallel 1-8MB Upport	\$12K ROM \$12K RAM	\$949 (E) \$1485 (T)
JETXPrint 100	Ethernet 10BaseT and BMC 4/10MB Token Ring (DS and S/40)	Single Novell	1 parallel 1-8MB Upport	\$12K ROM \$12K RAM	\$949 (E) \$185 (T)
JETXPrint 100	Ethernet 10BaseT and BMC 4/10MB Token Ring (DS and S/40)	Single Novell	1 parallel 1-8MB Upport	\$12K ROM \$12K RAM	\$949 (E) \$185 (T)

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CIRCLE 859 ON READER SERVICE CARD

IBM NetVIEW/6000

CONTINUED FROM PAGE NE4

is an extremely valuable asset.

A MIB application builder is also included to further utilize MIB variables. Take, for example, the Interface Traffic MIB variable. With the MIB application builder, constructing an application to monitor the interface traffic of a specific device and graph the results is easy. NetVIEW/6000 also makes event filtering a simple process. From the Filter editor, the administrator can filter out a variety of traps, letting only the crucial ones reach the Events monitor.

NetVIEW/6000 provides many features to enhance network management. But in order for the management platform to truly succeed (and, in this case, surpass HP OpenView) NetVIEW/6000 will have to expand its operating system support. NetVIEW/6000 is currently only available for AIX systems, whereas HP OpenView is available for Hewlett-Packard HP UX, SunSoft SunOS, and Microsoft Windows. IBM has announced support for Digital Equipment Corp.'s Alpha and Sun's OS, but only the AIX version running on IBM hardware is available today.

While increased operating system support will certainly help to increase NetVIEW/6000's base, third-party application development will ultimately be the deciding factor for the success of NetVIEW/6000. IBM has established the NetVIEW/6000 Association to help foster third-party application development for the NetVIEW/6000 platform. At present, there are over 70 vendors in the association, but only eight applications are available for the platform. By the beginning of 1994, however, 30 additional applications should be available.

There are some applications available today that distinguish NetVIEW/6000 from the competition. Systems Monitor, an IBM offering, is designed to provide distributed network management and is intended to reside on an AIX machine. Its principal function is to receive and process SNMP data, forwarding only the crucial data to the NetVIEW/6000 platform. By deploying Systems Monitor applications on the network, a distributed

management architecture can be established that will help to reduce traffic going to and alleviate processing activity on the NetVIEW/6000 platform.

Other applications available for the NetVIEW/6000 include IBM's HMP (Hub Management Program)/6000 for managing IBM 8250 hubs, Trouble Ticket for cataloging network events and traps, and SynOptics' LattisView for managing SynOptics hubs. Currently, however, the two largest router manufacturers' management applications are not supported—Cisco's CiscoWorks and Wellfleet's SiteManager. Also, no RMON application is available for the NetVIEW/6000, although IBM has pledged to deliver one by March 1994.

Overall, IBM's NetVIEW/6000 is a powerful new addition to the world of SNMP-based network management. Not

only has IBM set a new standard with NetVIEW/6000's user interface, but it has made network management even easier with tools such as the Topology Display, Navigation Tree, and MIB Browsers. In comparison with SunNet Manager and HP OpenView, there is no question that the NetVIEW/6000 is unparalleled as a management platform. Unfortunately, however, it has limited third-party support. Over the long term, though, when more vendors join the IBM NetVIEW/6000 association and when a greater number of third-party offerings are available, NetVIEW/6000 should be tough to beat.

• List price: *IBM AIX SystemView NetVIEW/6000, Version 2*, \$14,995. IBM Corp., National Telesales Center, P.O. Box 2150, Atlanta, GA; 800-426-2255; fax, 404-238-3442.

Circle 956 on reader service card

► HUBS

IBM Enters the Enterprise Hub Market

BY ROBERT P. LIPSCHUTZ

Faced with the increasingly heterogeneous nature of modern networks, IBM has launched itself into the enterprise hub market with the IBM 8250



NEW BLUE: IBM's new 8250 enterprise hub supports Ethernet, Token-Ring, and FDDI.

Multiprotocol Intelligent hub. The 8250, which is manufactured by Chipcom to IBM's specifications, can manage and support Ethernet, Token-Ring, and FDDI all in the same chassis.

Purchasing the 8250 involves a two-part decision. First, you must decide to consolidate your current assortment of Ethernet, Token-Ring, and FDDI

topologies into one enterprise hub, which can then become the central management point for your network. Second, you must decide whether the 8250 is the best enterprise hub for you. The IBM 8250 hub has an excellent management application that currently only runs under AIX NetVIEW/6000, and the 8250 also provides excellent fault-tolerance features and the proven reliability of IBM service and support.

Despite the management and customer support that come with the 8250, IBM's enterprise hub cannot yet compete successfully where it must: in the areas of flexibility and scalability against SynOptics and Cabletron, the market leaders. Flexibility in an enterprise hub means the ability to support all of the major network topologies—in all the different media flavors—and also support internetworking options such as bridging and routing. After all, the point of using an enterprise hub is to consolidate everything in one chassis. The 8250 provides simultaneous support for Ethernet (over unshielded twisted-pair, thick and thin coax, and fiber), Token-

Continues on page NE10

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CONTINUED FROM PAGE NE6

Many connectivity modules are available, including Ethernet transceivers, Ethernet-to-Ethernet bridges, Token-Ring source routing, and source routing transparent bridges. A few holes in the product line are the lack of routing, translational bridging, single-mode fiber, and LocalTalk modules. In contrast, Cabletron's MMAC provides all the flexibility provided by IBM's 8250 and adds third-party module support as well as router, translational bridging, single-mode fiber, and connectivity modules. The SynOptics 3030 departmental hub, meanwhile, supports all connectivity options except FDDI and LocalTalk.

Besides flexibility, an enterprise hub must also have the scalability to grow as your network grows. The IBM 8250 Model 6HC we tested provides six interface slots, allowing a maximum of 72 Ethernet or 60

SUMMARY OF FEATURES

ENTERPRISE HUBS

☒ = YES ☐ = NO

FEATURES

Number of slots	8	5	4
Maximum 10BaseT Ethernet ports (no management module)	72	110	96
Maximum UTP Token-Ring ports (no management module)	60	110	48
FDDI support			
Bridge module support			
Router module support			
PRICING			
Chassis with power supply	\$2,410	\$3,075	\$200
Unmanaged hub (all slots filled):			
Each Ethernet port	\$165	\$200	\$136
Each Token-Ring port	\$153	\$200	\$129
Managed hub (one management module installed):			
Each Ethernet port	\$239	\$273	\$165
Each Token-Ring port	\$295	\$247	\$280
Advanced management modules:			
Ethernet	\$3,990	\$7,995	\$3,995
Token-Ring	\$5,980	\$5,495	\$5,195

Token-Ring ports if no management module is used. IBM also sells a 17-slot version of the 8250. The 8250's slots are very small, and many of the communications cards—such as the 24-port Ethernet and 20-port

Token-Ring modules—take up two slots each. Additionally, the 24-port Ethernet switch uses a Telco connector instead of separate RJ-45 ports and hinders the plug-and-play options at the patch panel. The

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3Com's NETBuilder II® earned a perfect score in every single test.



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And so flexible, it can support Novell's IPX, AppleTalk,

First Perfect Over

Cisco device takes a licking, but
3Com bridge-router keeps on tickin'

B. EDWIN E. MYER
AND CHRIS GIULIANO

[illegible]

PRODUCT
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ESTING

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Packet Exchange traffic to handle the maximum 1000 packets per second. DECnet traffic load in 64 of the test scenarios.

Testing

Cabletron MMAC, on the other hand, can support up to 24 Token-Ring or Ethernet ports in each of its five slots (110 total ports), while the SynOptics 3030 supports 12 Token-Ring and 24 Ethernet ports in each of its four slots. The six-slot 8250 does not compare favorably with Cabletron's MMAC or SynOptics' 3030 in terms of scalability (see accompanying chart).

With IBM's AIX NetVIEW Hub Management/6000 application, all modules in the 8250 hub can be managed through the NetVIEW graphical user interface. To enable management, the 8250 must be fitted with Ethernet and Token-Ring management modules, each of which occupies one interface slot. The management modules provide traffic and error statistics for their respective topologies. The advanced Token-Ring management module also provides beacon isolation, a handy feature for troubleshooting the common beaconing problem of Token-Ring adapters. Remote Monitoring support, which allows for increased statistics monitoring and packet capture, is not available.

The 8250 provides the fault tolerance you require of an enterprise hub, including redundant power supplies. Additionally, all communications boards are hot-swappable and can be configured on-line.

Price-per-port figures for the 8250 range from \$153 for Token-Ring to \$165 for Ethernet in a fully populated, unmanaged configuration. With management modules, the price per port comes up to \$295 and \$239 for Token-Ring and Ethernet, respectively. Overall, the 8250's price per port is quite competitive with that of Cabletron's MMAC, though SynOptics' 3030 offers the cheapest per-port pricing of the group.

As IBM's first step into the heterogeneous networking environment, the 8250 is a symbolic gesture. With the 8250, IBM is telling the world that it is no longer playing

the Token-Ring-only game. The hub does not yet match the overall capabilities of the market leaders, but it provides a solid enterprise hub solution nonetheless. Currently, the 8250 management application only runs under IBM's NetVIEW/6000, which can be limiting for some shops. We expect the 8250 to shore up some of its limitations while adding future support for ATM and switching technologies.

• List price: *IBM 8250 Multiprotocol Intelligent Hub, Model 6HC: Chassis, \$2,410. Modules: Ethernet, \$1,680 to \$3,145; Token-Ring, \$1,255 to \$2,260; FDDI, \$8,395 to \$13,125. IBM Corp., National Telesales Center, P.O. Box 2150, Atlanta, GA; 800-426-2255; fax, 404-238-3442.*

Circle 957 on reader service card



We invite you to discuss Network Edition articles and story ideas with PC Magazine editors David Greenfield and Frank J. Derfler, Jr., in the Network Edition section of PC Magazine's Editorial Forum. Type GO ZNT:EDITOR from any ZiffNet or CompuServe prompt.

aw. We routed.

Score Earned

PERFORMANCE IN A MIXED LAN ENVIRONMENT

Results from an Ethernet and a Token-Ring LAN were sent from NetBuilder II to a central server. The results show that the number of packets sent and received by the server was 100% for all configurations. The results also show that the number of packets sent and received by the server was 100% for all configurations. The results also show that the number of packets sent and received by the server was 100% for all configurations.

Product also in bytes	
No. of nodes	
100%	100%
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Product also in bytes	
No. of nodes	
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No. of nodes	
100%	100%
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IBM NetBIOS/NetBEUI, Banyan VINES, DECnet, XNS, OSI, and TCP/IP protocols. Not to mention any LAN or WAN media, including FDDI and other high-speed media that come along.

NETBuilder's modular design means interface, media, topology, and technology changes can be made in no time. Plus, hot-swappable modules make network problems easy to repair, with absolutely no interruption in service. In fact, meantime board replacement is less than five minutes. Want to know more about NETBuilder II? Give us a call at **1-800-NET-3Com.**

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Networks That Go the Distance

► NETWORK MANAGEMENT

Taking the First Steps Toward Computerized Network Planning

BY STEVE RIGNEY

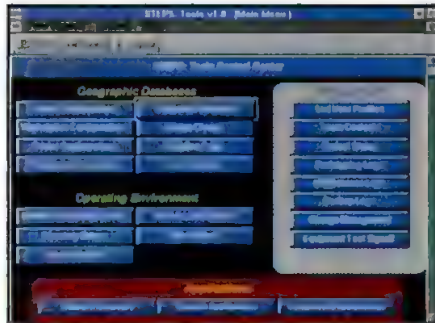
Steps: Tools for Windows, Professional Edition, from Cauchi Dennison & Associates, is the first software product designed specifically to help you plan, install, and support your network. You can use Steps' collection of electronic forms, relational database, and Microsoft Project for Windows' templates to plan and track everything from your network cable to the people you'll need to install and administer your network.

Steps costs \$199 and requires Microsoft Project for Windows 3.x and either Delrina PerForm Pro Plus or Delrina FormFlow.

The Steps manual is well written, but you must read it carefully before attempting to install the software. We were disappointed to find that Steps does not include an automatic installation routine. In fact, you have to create the directories, copy the program files, and create a Windows icon manually. Moreover, if you want to take full advantage of Delrina's security features, you must install Steps *before* you install PerForm Pro Plus. (You may have to reinstall PerForm Pro Plus.) If you do not need the security features, however, PerForm Pro Plus and Microsoft Project must be installed first.

After you install the program, Steps offers a friendly Windows interface that you can use to work through various network projects using forms and process charts. The forms come from either Delrina PerForm Pro Plus or FormFlow, and the process charts are edited and created using Microsoft Project for Windows. You use the forms utility to collect and retrieve data, and you use the process charts function to plan, schedule, and generally manage your network. All of the forms are linked together, so information that is changed in one form is also changed in the other relevant forms.

Generating the forms is easy, but the process charts are complicated enough to require a basic knowledge of project man-



MASTER CONTROL: The Control Center divides your network into four areas.

agement and a good knowledge of Microsoft Project. These charts are a collection of Project management templates that map out the various tasks and sub-tasks of implementing a LAN. Steps-customized project evaluation and review technique (PERT) charts display the steps and milestones of supporting and installing your network.

The main menu, or Control Center, is broken into four main sections, each of which is broken into smaller subsections. The Management section stores detailed

information relating to management activities such as network maintenance logs and troubleshooting data. The Geographic Database stores data concerning the infrastructure of the network, while the Operating Environment section holds data on the network and desktop operating systems. Finally, the Applications section stores information on the types of applications you use in your organization. Unlike most software and hardware inventory applications, however, Steps requires that you *manually* enter all of the network data.

The package includes a book entitled *Steps for Implementing Local Area Networks: A Business Guide*, which is designed to help you use and understand the software and understand LANs in general.

The Steps software requires a great deal of time and is certainly not a product for every network administrator. However, despite its convoluted installation procedure, if you have a major investment in your network and feel that a computerized planning and management tool will help you keep control of your resources, Steps: Tools for Windows has a place in your network planning activities.

• **List price:** *Steps: Tools Software for Windows, Professional Edition*, \$199. Cauchi Dennison & Associates Inc., 367 Spadina Rd., Toronto, Ontario, Canada M5P 2V7; 416-481-5047; fax, 416-485-6566.

Circle 968 on reader service card

Driver Alert

The following table lists recently released software drivers and utilities from Intel and Novell. This software can be obtained from Library 9 (\$05 Driver Alert) of the Utilities/Tips Forum on ZiffNet. A complete source of network technical-support information, including technical articles, documentation, and supplemental software from leading manufacturers and software publishers, can be found in *Support On Site*, the monthly CD-ROM published by Computer Library (212-503-4400).

Filename	Size (kilobytes)	Release date	Title and description
NPADUP.EXE	262	9/16/93	Intel NPADMIN, Version 2.00: Can filter on a single Netport ID or alias
POP911.EXE	69	9/3/93	Intel Version 1.911 of LANSelect. For use with the Print Management package for Netport II and required with NPADMIN, Version 1.55 or later
E16ADF.EXE	5	9/2/93	Intel EtherExpress 16 MCA ADF file, Version 1.01: Separates options for the RJ-45 and BNC connectors into two selections
UPDT35.EXE	96	9/3/93	Intel LANProtect Virus update.
LANDSK.TXT	22	8/31/93	Intel LANDesk troubleshooting guide
LTAS16.EXE	28	9/3/93	Intel EtherExpress 16 drivers for Artisoft LANtastic AI.
BSOUP.EXE	57	9/13/93	Novell Black Screen of Death. Fixes a workstation-crashing problem that occurs when running Windows or Windows for Workgroups over a network
PSERV5.EXE	155	9/10/93	NetWare 3.11 and 2.2 printing files: Update of NetWare PSERVER (NLM, Version 3.76) and APPRINTER components (Version 3.75).

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Maintenance and reporting are simple, too, thanks to a feature called domain management. It lets you group file servers and PCs and apply a single server setup to all of them.

LANDesk Virus Protect also automatically updates

virus patterns via Intel's BBS, then distributes the most current pattern library in the virus-library directory.

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► FDDI ADAPTERS

CNet's New FDDI Adapter Strikes Out

BY JEFFREY D. BAHER

Fiber Distributed Data Interface (FDDI) is a proven standard for high-speed networking, but CNet Technology's new EISA Bus Master FDDI Adapter is a reminder that not all FDDI adapters are created equal. Although it costs \$200 to \$300 less than most EISA FDDI adapters, its manifold deficiencies grossly outweigh any monetary savings.

In comparison with popular EISA Bus Master FDDI adapters, such as 3Com's FDDILink-F 3C771, CNet's FDDI adapter is a failure. Not only did it perform miserably, but it is also plagued by limited driver support, system incompatibilities, and poor documentation. This all contributes to a less than favorable beginning for CNet in the competitive FDDI adapter market.

ZD Labs' NetBench 2.06 NIC Throughput Test revealed dramatic differences between the CNet adapter and the 3Com adapter. On the server adapter test,

the 3Com achieved 67-megabit-per-second (Mbps) throughput using the largest block size while the CNet clocked in at only 49 Mbps.

This sluggish throughput can be attributed primarily to an inefficient use of the server's CPU; a poor bus-mastering implementation. While bus-mastering is intended to reduce host CPU utilization as data moves from the adapter to the host PC, CNet's bus-mastering implementation is no help at all. In fact, with a CNet adapter in the server, the server's CPU maxed out at 99 percent utilization for all tests, explaining the low throughput. CPU utilization here is a bottleneck that prevents throughput from exceeding 50 Mbps. 3Com, on the other hand, uses the server's CPU more efficiently, and thus CPU utilization does not inhibit network throughput.

Even as a workstation adapter, it is a weak performer. Its throughput ranged from 0.2 to 11 Mbps (depending on block size). Even at the point where the scores converged most closely, the 3Com FDDILink's lowest throughput score was nearly double that of the CNet (19Mbps on the 4K block size).

The CNet also comes up short in a variety of other areas. It ships with ODI drivers only. Sorry, VINES, LAN Server, and Microsoft LAN Manager users: No NDIS support here. And if you're looking for clear and complete installation instructions, don't look to the manual. Not only was the documentation sparse and incomplete, but some of the manuals were missing pages. And did you say you wanted to run Microsoft Windows? Well, you can with the CNet adapter, but only in Windows' Standard mode. The 386 Enhanced mode, which allows users to access Windows' virtual memory capabilities, isn't supported. A driver upgrade is planned, but no release date has been set.

Also puzzling was the CNet's inability to operate in a Compaq Systempro/XL50, our standard test server. We have not encountered this problem with any other adapter. CNet is aware of the incompatibility, but has not communicated a solution.

Unfortunately for CNet, its new FDDI adapter is a weak competitor in a market fueled by top-notch, quality-conscious vendors. No savings could ever justify a move away from one of the mainstream vendors, such as 3Com or Network Peripherals, toward CNet's adapter.

• List price: CNet EISA Bus Master FDDI Adapter, \$1,499. CNet Technology Inc., 2199 Zanker Rd., San Jose, CA 95131; 408-954-8000; fax, 408-954-8866.

Circle 963 on reader service card

Benchmark Tests: FDDI Adapters

It wasn't even close: The 3Com FDDILink-F Model 3C771 EISA was clearly the better adapter reviewed. As a server adapter, the 3Com outperformed the CNet EISA Bus Master FDDI Adapter and was considerably more efficient with all block sizes. Even as a workstation adapter, where CPU utilization is not a crucial factor, the CNet delivered weak results.

The server test environment consisted of one Dell 450/ME server and four Compaq Deskpro 486/33M workstations. The workstation test environment con-

sisted of one Dell 450/ME server and a Compaq Deskpro 486/33M workstation.

The **NIC Throughput** test from NetBench 2.06 evaluates the amount of data an adapter can transfer across the network in 1 second. A workstation equipped with the adapter issues a series of read requests to a file stored in the server's cache.

The **Performance Index** is a ratio of bandwidth utilization to CPU utilization as measured by Novell's STAT.NLM.

NIC THROUGHPUT (SERVER)

Megabits per second

Block size ►

64 bytes	512 bytes	1K	4K
1.2	8.3	16.7	48.7
4.1	24.6	40.8	66.8

Higher scores represent better performance

CPU UTILIZATION

Percent

Block size ►

64 bytes	512 bytes	1K	4K
99.0	99.0	99.0	99.0
95.0	82.9	79.8	60.5

Lower scores represent better performance

PERFORMANCE INDEX (SERVER)

Block size ►

64 bytes	512 bytes	1K	4K
0.0	0.1	0.2	0.5
0.0	0.3	0.5	1.1

Higher scores represent better performance

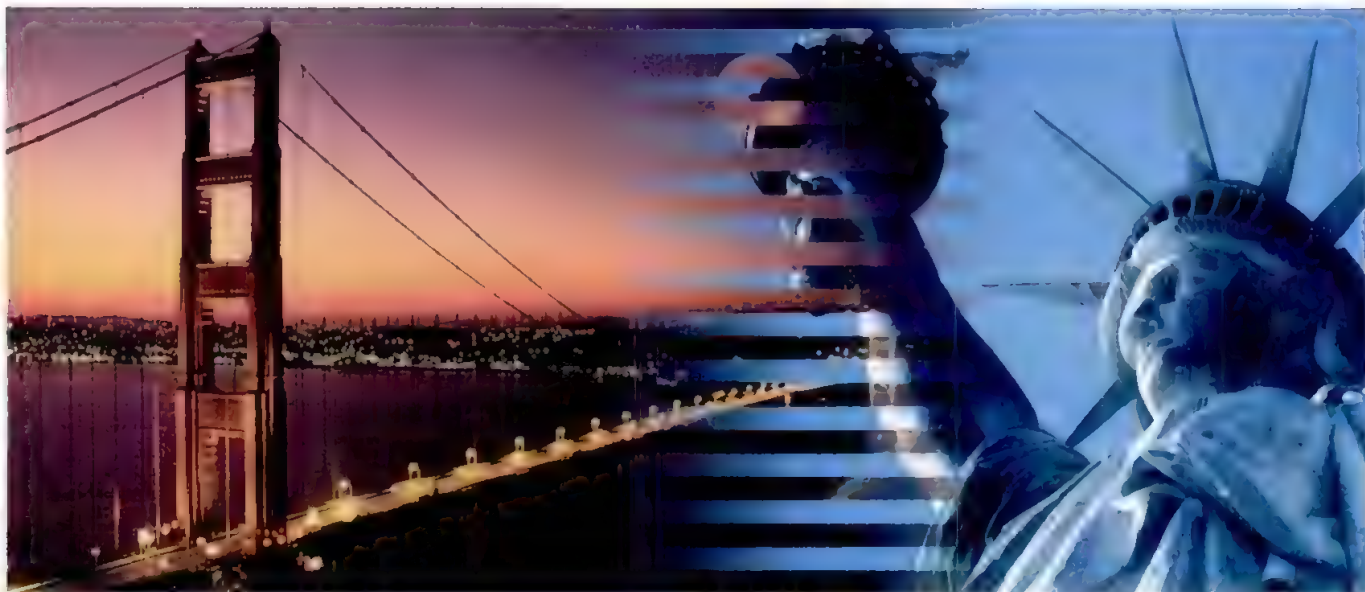
NIC THROUGHPUT (WORKSTATION)

Megabits per second

Block size ►

64 bytes	512 bytes	1K	4K
0.2	1.8	3.5	10.7
1.1	6.6	10.9	18.7

Higher scores represent better performance



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CIRCLE 854 ON READER SERVICE CARD

► ETHERNET ADAPTERS

Cogent Claims To Deliver Faster Ethernet

BY JEFFREY D. BAHER

With all the hype about 100-megabit-per-second (Mbps) Ethernet, is anyone still trying to enhance traditional 10-Mbps Ethernet? Cogent Data Technologies, with its Predictive Pipelining Ethernet technology, certainly is. The vendor claims that when its adapters are installed in your server as well as your workstation, your network will achieve peak performance. Unfortunately, Cogent's solution requires the purchase of new workstation *and* server adapters.

Over the past few years, vendors have worked to improve the age-old Ethernet technology. Most notably, 3Com Corp. gained recognition for its Parallel Tasking technology. But in real-world situations, where Ethernet collisions are common-

place, the overall performance slows down. Cogent that its Predictive Pipelining solution surpasses Parallel Tasking.

The primary difference between the two technologies centers on how the adapters and drivers interact with the network operating system. Predictive Pipelining interacts with the NOS on a message-by-message basis, not a packet-by-packet basis like Parallel Tasking. Take, for example, the transmission of a DOS copy from a local drive to a file server: The copy command and the subsequent data are broken down into message units that the NOS can handle.

With Parallel Tasking, the NOS translates the message into Ethernet packets. The driver receives and transmits the packets to the receiving node. At the receiving end, the driver reads the packets' header and begins processing the first packet, pre-

dicting that the rest of the packets will come. If a collision occurs the packet must be retransmitted. When the packet is finally received, it is passed up to the NOS.

With Predictive Pipelining, the NOS sends the entire message to the driver in a single packet. At the adapter, the driver translates the large packet into smaller, legal Ethernet packets. The receiving adapter performs the reverse process. Incoming Ethernet packets are reassembled to make one large packet that the NOS then reads.

Results from ZD Labs' NetBench 2.1 NIC Throughput test reveal some advantages to Predictive Pipelining, but only when Cogent adapters are installed in both workstation and server. With an Eagle NE3200 32-bit bus-mastering EISA adapter in the server, 3Com's 3C509 ISA adapter outperformed Cogent's EM525. With a

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Benchmark Tests: Ethernet Adapters

With an Eagle NE3200 adapter in the server (configuration 1), the Cogent EM525 ISA adapter proved less efficient than the 3Com 3C509 ISA adapter. Even with a Cogent EM935 XL adapter in the server (configuration 2), the EM525 was the low performer except with the largest block size. But when background traffic was added to that setup (configuration 3), the EM525 performed as well as the 3C509, excelling with the larger block sizes. The test environment consisted of one Compaq Systempro/XL50 server and one Deskpro 433/M workstation.

The **NIC Throughput** test from NetBench 2.1 evaluates the amount of data

that an adapter can transfer across the network in 1 second. A PC equipped with the adapter issues a series of read requests to a file stored in the server's cache. The test uses block sizes ranging from 64 bytes to 4K.

NIC THROUGHPUT (CONFIGURATION 2)

Megabits per second

Block size►	64 bytes	1K	2K	4K
Cogent EM525 ISA adapter	0.8	4.6	6.2	7.3
3Com 3C509 ISA adapter	1.0	6.4	6.7	6.8

NIC THROUGHPUT (CONFIGURATION 3)

Megabits per second

Block size►	64 bytes	1K	2K	4K
Cogent EM525 ISA adapter	0.5	4.3	4.4	5.6
3Com 3C509 ISA adapter	0.5	4.3	4.3	4.3

NIC THROUGHPUT (CONFIGURATION 1)

Megabits per second

Block size►	64 bytes	1K	2K	4K
Cogent EM525 ISA adapter	0.5	3.6	3.5	3.5
3Com 3C509 ISA adapter	0.5	4.4	4.5	4.4

Higher scores represent better performance.

Cogent EM935 in the server, the 3C509 still outperformed the EM525 except for the 4K block size. The EM525's success with the 4K block size is testimony to Predictive Pipelining's efficiency when messages cannot fit into one legal Ethernet packet. Predictive Pipelining also proved better when background traffic was introduced.

Predictive Pipelining really shines with the transfer of large files when background traffic is present. Nevertheless, the question still remains: Can you afford to replace all your server and workstation adapters in order to capitalize on the strengths of Predictive Pipelining?

• List price: *Cogent EM525 AT Ethernet*

LAN adapter: for UTP, \$188; for AUI, BNC, and UTP, \$218. Cogent EM935 EISA XL 32-bit bus-mastering adapter, \$498. Cogent Data Technologies Inc., 175 West St., P.O. Box 926, Friday Harbor, WA 98250; 206-378-2929; fax, 206-378-2882.

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NEW

SynOptics Positions Lattis System 5000 as a Hub of Hubs

SynOptics Communications recognizes the need to reduce the cost of efficiently managing a network, so it's announced a hardware/software solution. The Lattis System 5000 intelligent hub and Optivity, Version 4.0 for SunNet Manager, network management system combine to provide users with both switching capabilities and logical workgroups.

SynOptics employs two techniques to tackle the problems that currently face network managers: using network personnel efficiently and viewing the LAN effectively. The first is a physical change in the hub that allows individual ports and the devices connected to those ports to be switched from segment to segment through software. Network managers no longer have to travel from site to site to solve a networking problem, thus reducing the costs and time spent administering the LAN. Secondly, network managers can view the network in logical (not physical) workgroups. All of the network statistics, device usage, and problems can then be grouped for each cluster of users.

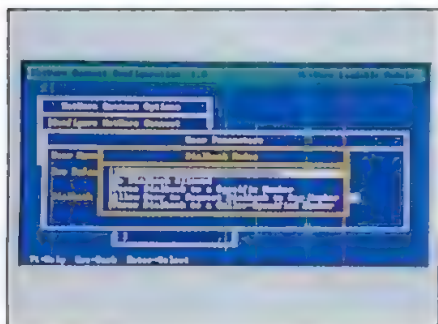
The 5000 is a 14-slot chassis that can accommodate Ethernet, Token-Ring, and FDDI modules. Optivity, Version 4.0, exploits the functionality of the 5000, allowing network managers to connect and disconnect devices from specified LANs and create logical workgroups. The 5000 becomes the hub of hubs: All devices connect back to the 5000 either directly or indirectly through other hubs. This announcement helps move SynOptics' focus from managing individual components to managing the entire network.

• List price: *Lattis System 5000*, \$1,300 to \$4,600 per segment; *Optivity, Version 4.0 for SunNet Manager*, \$5,995. SynOptics Communications Inc., 4410 Great America Pkwy., Santa Clara, CA 95054; 408-988-2400; fax, 408-988-5525.

Circle 960 on reader service card

NEW

Novell Introduces New Platform for Remote Access



DIAL-BACK: Just one of many security features.

Novell's remote and local network users now have a platform for cost-effective shared communication. NetWare Connect provides remote communications for mobile and network users, supporting inbound and outbound communications. Network administrators no longer have to invest in multiple communications servers, desktop modems, and phone lines: Remote-node, remote-control, and dial-out users can share modems and lines.

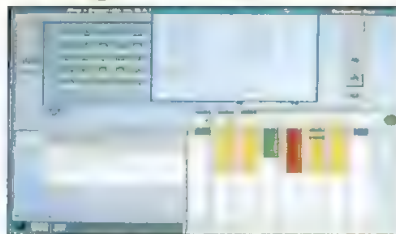
Remote PC users can now exchange e-mail and access files as remote nodes in conjunction with NetWare client software. At the same time, network users can dial out for access to bulletin boards, service bureaus, or remote host systems. The platform features dial-back security and is available with 2, 8, or 32 ports.

• List price: *NetWare Connect: 2 ports*, \$595; *8 ports*, \$2,195; *32 ports*, \$5,995. Novell Inc., 122 East 1700 South, Provo, UT 84606-6194; 800-453-1267, 801-429-7000.

Circle 959 on reader service card

HOT PROSPECT

Cabletron Unveils New Management System



Cabletron Systems' new three-phase plan targets tighter integration and distribution of network management. The first phase involves the December release of Spectrum for Element Managers. Its purpose is to enhance major element management systems by providing adapter applications, called Spectrum Portable Management Applications (PMAs). The PMAs provide management of Cabletron's products in HP OpenView Unix, IBM AIX NetView 6000, SunNet Manager, and Novell NMS environments.

Phase two, Spectrum Data Gateways (available in the first quarter of 1994), provides a link between popular element managers, allowing data to be exchanged among them.

The third phase of Cabletron's plan, Spectrum, Version 2.1 (available in the second quarter of 1994) provides a distributed platform (of SpectroServers) for enterprise-wide network management.

• List price: *Spectrum for Element Managers*, \$3,995; *Spectrum Data Gateways*, *Spectrum, Version 2.1*, pricing to be announced. Cabletron Systems Inc., 35 Industrial Way, Rochester, NH 03867-0505; 603-332-9400. Circle 435 on reader service card

NEW

XTree Debuts Modular Network Management

XTree's latest entry into the network management market provides network managers with a more effective means to assess network status and detect network problems, allowing management of operating systems, devices, and workstations. Previously, network managers managed their networks on a device-by-device basis or attempted to remain compatible with their network operating systems. As an alternative, XTree offers its new modular management system, NetControl. The NetControl system integrates a variety of management modules with a set of core network management services. Using SNMP protocols, the XTree NetControl system offers a logical view (based on user setup rather than physical topology) of all SNMP devices; workstations; NetWare 2.2 or later, NetWare 3.x, LAN Manager, or VINES servers and services; and TCP/IP-based networks.

In addition to providing centralized management, the program also features alerting and paging, trouble-ticketing, and multiple security levels—all for ease of use. The system comprises a variety of modules: The Console Module provides management services to all the other modules, the Server Modules allow the user to down or restart the server, and the Device Modules (Intelligent Hub Module, Router Module, and RMON Module) allow the user to manage products from SynOptics and other vendors.

- List price: *NetControl Console Module*, \$995 per station; *NetControl Server Modules*, \$995 per managed server; *NetControl Device Modules*, \$495 per managed device. XTree Co., 4115 Broad St., Building 1, San Luis Obispo, CA 93401-7993; 800-333-6561, 805-541-0604; fax, 805-541-4762.

Circle 961 on reader service card

IMPROVED

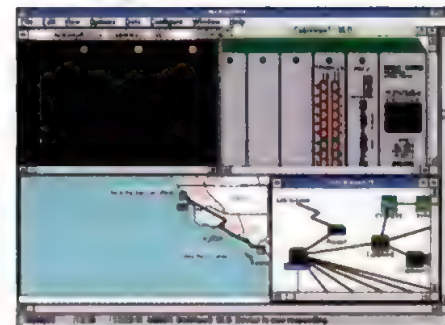
The Wollongong Group Offers SNMP-2

The Wollongong Group is positioning itself as one of the first companies to support the SNMP-2 protocol. PathWay Management Station, Version 3.1, supports a distributed network architecture, allowing management tasks to be shared across the network. The distributed architecture lends itself to more efficient network management: It enables manager-to-manager communication for the correlation of network information.



FOLLOWING A NEW PATH: Version 3.1 incorporates the new SNMP-2 protocol.

- List price: *PathWay Management Station, Version 3.1*, \$10,000. The Wollongong Group Inc., 1129 San Antonio Rd., Palo Alto, CA 94303-4374; 415-962-7100; fax, 415-969-5547. Circle 962 on reader service card



BIG PICTURE: Integrates management of networks, intelligent devices, and workstations.

SNMP-2 is a replacement for the Simple Network Management Protocol that is currently in use. The new standard enhances features and addresses faults found in the original version. Some of the improvements focus on problems such as inefficient bulk-data transfer, lack of security, and cryptic error codes.

Other new features include alarm correlation, distributed rule-based expert system and report generation, and enhanced discovery and automatic map drawing.

BRIEFS

COMMUNICATIONS

NetManage Inc. added support for rules-based filtering of Internet mail and support for Version 3 of the Post Office Protocol (POP3) internetworking mail protocol to NetMail, an application in NetManage's Chameleon TCP/IP for Windows product family. Rules-based filtering aids network managers in organizing and managing high volumes of mixed-traffic e-mail. POP3 allows users to retrieve mail being held at a mail server or through dial-up access. NetMail is included in both Chameleon, Version 3.11 (\$400 per single user) and ChameleonNFS (\$495). 408-978-7171; fax, 408-257-6405.

Calculus Inc. introduced OutPost, a new remote-messaging system. OutPost is a combination hardware/software solution for increasing the real-time e-mail responsiveness for WAN and remote locations. OutPost RSU and the remote-terminal software are available for \$299, and the gateway software costs \$199 for the 10-user version and is also available for 20, 50, 100, 250, or 1,000 users. 305-481-2334; fax, 305-481-1866.

Mustang Software Inc. enhanced its QmodemPro communications software. Version 1.51 (\$99) is capable of handling e-mail from multiple sources. A newly integrated gateway, AMGate, allows network managers to send or retrieve messages via major on-line services, including MCI Mail, CompuServe, CompuServe Forum Mail (a public mail system), and any bulletin board system supporting .QWK Mail packets. Version 1.51 also includes a common interface, Off-Line Express, that features a 124,000-word dictionary and a flexible address book. 805-395-0223; fax, 805-395-0713.

What are
YOU
waiting
for?

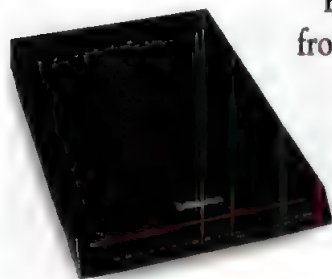


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If you own an older architecture Courier modem, please fax us at (708) 982-0823 to inquire about our trade-in policy.

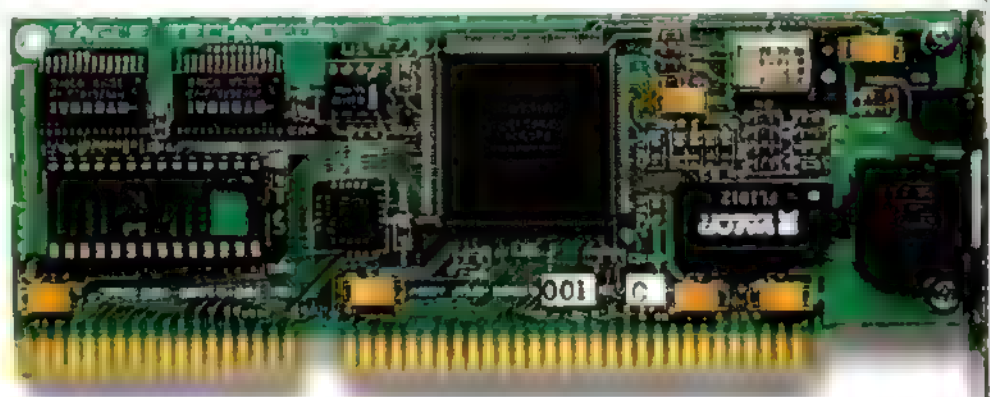


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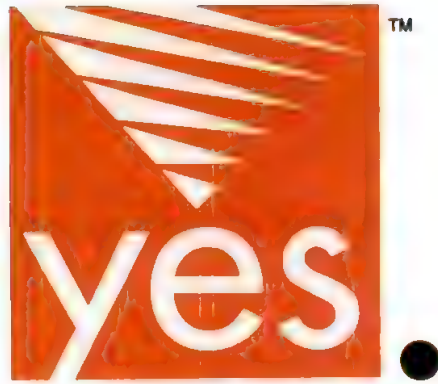
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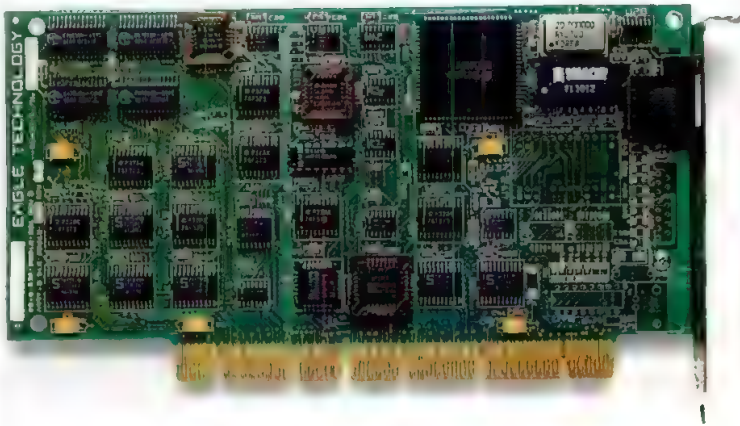
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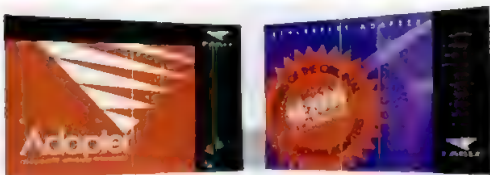
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CIRCLE 860 ON READER SERVICE CARD

NEW

CrossCom, Transcend to Add Supercompression to Routers

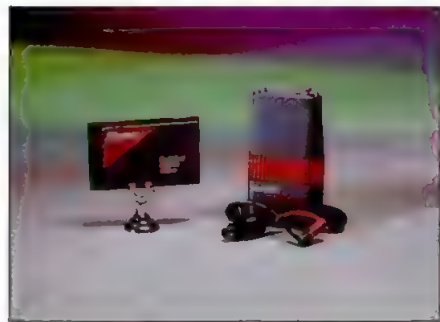
CrossCom Corp.'s future router releases will center on cutting the cost of LAN/WAN communication. The company's solution is based on a recent alliance with Transcend Technologies Corp. and the integration of a new supercompression technology called ASH (Ardire-Stratigakis-Hayduk) into CrossCom's ILAN family of routers. ASH technology compresses multiple streams of data traveling through the router at ratios of up to 4:1. The high compression rates reduce the amount of bandwidth needed to send data and also reduce the need for higher speeds. ASH supercompression technology will be incorporated across CrossCom's entire line of routers at a future date. The combination will offer network managers a less complicated, less costly approach to routing.

• List price: *CrossCom Corp.*, 450 Donald Lynch Blvd., Marlborough, MA 01752; 508-481-4060; fax, 508-490-5535. *Transcend Technologies Corp.*, 959 Bassett Rd., Westlake, OH 44145; 216-835-4882.

NEW

Xircom Delivers Adapter/Modem Products

Xircom once again tackles the portable connectivity market with the introduction of two new adapter/modem products. The Xircom CreditCard Ethernet Modem and the Xircom Pocket Ethernet Modem combine the functionality of a LAN adapter and a modem. Small, convenient, and reasonably priced, the products provide both local and remote LAN connectivity as well as fax/modem communications.



TWO-IN-ONE: Delivers both local and remote connectivity.

Both adapter/modems offer 10-megabit-per-second throughput when they are connected to an 802.3 Ethernet LAN and 14.4-kilobit-per-second throughput when they are connected to a V.32bis modem. The modems provide support for

drivers for Banyan's VINES, Digital Equipment Corp.'s Pathworks, Microsoft LAN Manager, and Novell's NetWare.

• List price: *Xircom CreditCard Ethernet Modem*, \$699; *Xircom Pocket Ethernet Modem*, \$699. *Xircom Inc.*, 26025 Mureau Rd., Calabasas, CA 91302; 800-874-7875. Circle 963 on reader service card

IMPROVED

Novell Updates Popular Network Operating System

Novell's latest version of its most popular network operating system promises fixes and functionality. NetWare, Version 3.12, boasts performance enhancements including support for packet burst and large Internet packets—enhancements for Version 3.11 previously available only through Novell's electronic bulletin board, NetWire.

Version 3.12 provides support for Macintosh workgroups with a five-user license for NetWare for Macintosh. Basic Message Handling System (MHS) is available free, delivering MHS messages for e-mail, faxing, forms processing, and workflow automation. Novell makes moving up the NetWare ladder easy by providing compatibility with existing NetWare Loadable Modules.

• List price: *NetWare, Version 3.12: 5 users*, \$1,095; *50 users*, \$4,995; *100 users*, \$6,995. *Novell Inc.*, 122 East 1700 South, Provo, UT 84606-6194; 800-453-1267, 801-429-7000. Circle 964 on reader service card

BRIEFS

COMMUNICATIONS

Siren Software Corp. announced a new e-mail and fax package for open systems computing platforms including Sun SPARC, HP 9000, IBM RS/6000, and Silicon Graphics. Siren Mail (\$295 for a single-user license, \$1,395 for a 5-user license, and \$2,495 for a 10-user license) supports TCP/IP and Unix mail transports, RFC822/MIME Internet protocols, and fax servers for sending messages and documents worldwide. The communications package also features multifolder management, search and sort capabilities, and a built-in address book. 800-457-4736; 415-322-0600; fax, 415-322-9999.

FEL Computing announced a new TCP/IP gateway that allows users of a variety of PC LANs, including Artisoft's LANtastic, IBM LAN Server, Microsoft LAN Manager, NetWare, and VINES, to access any TCP/IP or Unix host. The LANlink-TCP gateway (\$1,495 for a 5-user session) supports ARCnet, Ethernet, Token-Ring, and other PC LAN technology. The software solution allows network managers to add a TCP/IP gateway without having to change their network adapters or workstations. 800-639-4110; 802-348-7171.

ViTel International Inc.'s new service links electronic mail users to fax, Telex, and other e-mail users worldwide. Through a transparent front end, the ViTel Worldwide MHS Hub (\$35 per month) allows users of a variety of LAN or PC applications compliant with Novell's Message Handling System (MHS) to send faxes, telexes, or e-mail via ViTel's worldwide messaging network. Some of the applications supported include Da Vinci Corp.'s Da Vinci eMail and Lotus Development Corp.'s cc:Mail. 800-733-6070.

Networked PC management? . . . I just insert
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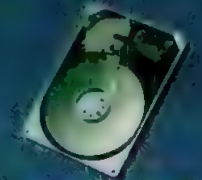
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Auto update



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"I don't have time
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I want instant control."

Intel SMART technology



Tick. Tick. Tick. If LAN adapter hassles have you strapped for time, take control with Intel's EtherExpress™ Flash adapters. Built-in features simplify installation, so networked PC management is instant.

With an Intel FlashC adapter, making your PC network-ready is as easy as plugging it in and switching it on. Set-up routines are stored within its flash memory, so the card automatically configures itself and downloads the appropriate NetWare® drivers. And one card accommodates BNC, AUI and 10Base-T cabling. (It's called smart technology, and it's going to make things much easier for you.)

FlashC adapters let you automatically create an inventory of PC software configuration files and hardware assets.

Information that can also be centrally viewed using Intel's LANdesk Manager software. FlashC even includes Intel FlashVirusProtect™ for extra protection.

All these features (and more) recently established the Intel EtherExpress FlashC LAN adapter as the number one card in a major adapter survey. To see what FlashC can do for you—and to learn about current promotions—call Intel's automated FaxBack® service at 1-800-525-3019 and ask for document #9732. We'll put you in control in a matter of minutes.

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†New FlashVirusProtect software will be available in Fall 1993.

CIRCLE 882 ON READER SERVICE CARD

NEW

Farallon Enables Expansion of Ethernet Networks



THE WAVE: Daisy chains multiple PCs, Macs, and printers.

Farallon offers a simple and cost-effective method for maximizing a 10BaseT Ethernet network—daisy chain technology. So you want multiple PCs and Macs without the expense or hassle of adding nodes or expensive cabling? Well, Farallon's new EtherWave transceivers and adapters allow network managers to daisy-chain up to eight devices (PCs, Macs, and printers) from a single RJ-45 hub port.

• List price: *EtherWave AUI Transceiver*, \$129; *EtherWave AAUI Transceiver*, \$129; *EtherWave ISA Card*, \$229; *EtherWave NuBus Card*, \$229; *EtherWave LC Card*,

\$229; *EtherWave LC Card with FPU*, \$369; *EtherWave Mac/PB Adapter*, \$379; *EtherWave Printer Adapter*, \$419; *EtherWave Newton Adapter*, \$439. Farallon Computing Inc., 2470 Mariner Square Loop, Alameda, CA 94501-1010; 510-814-5100; fax, 510-814-5020.

Circle 965 on reader service card

NEW

Motorola's New Routers Offer Multiprotocol Support

Motorola UDS' BitRUNR Turbo CS and BitRUNR XP are two of the industry's first dial-up routers to support the AppleTalk, NetWare IPX, and TCP/IP protocols simultaneously. Motorola is marketing the routers in five areas: dial-in access for remote and mobile users, LAN-to-LAN connectivity, remote point of presence, LAN dial-out access to information services, and remote network management.

Designed as a central-site router, the BitRUNR Turbo CS features 4 to 26 asynchronous ports, up to 3 T1/E1 synchronous ports, and up to 6 128-kilobit-per-second (Kbps) WAN connections. Designed for remote offices and small central sites, the BitRUNR XP supports 3 to 19 asynchronous WAN ports and one Ethernet card, and can be expanded to support one T1/E1 and one 128-Kbps WAN connection.

• List price: *BitRUNR Turbo CS*, \$2,495; *BitRUNR XP*, \$2,495. Motorola UDS, 5000 Bradford Dr., Huntsville, AL 35805-1993; 205-430-8000; fax, 205-430-8926.

Circle 966 on reader service card

IMPROVED

Frye Upgrades Monitoring Utilities

Frye Computer Systems' newest version of its network monitoring software sports over 30 new features. These new capabilities make Frye Utilities for Networks: NetWare Early Warning System, Version 1.5, more secure, comprehensive, and convenient. The use of multiple server configurations allows network managers to set thresholds for selected groups or individuals.

Other new features include additional response options for automatically correcting detected network problems, scheduled monitoring, node monitoring, and the ability to run baselines. Network security is maintained through user monitoring, keyboard locks, and password protection.

• List price: *Frye Utilities for Networks: NetWare Early Warning System, Version 1.5*, \$495. Frye Computer Systems Inc., 19 Temple Place, Boston, MA 02111; 800-234-3793, 617-451-5400; fax, 617-451-6711.

Circle 967 on reader service card

BRIEFS

MODEMS

Multi-Tech Systems Inc. enhanced the voice quality of its Personal Communications System (PCS) firmware and software by developing two algorithms for compressing speech to 16 Kbps and to 9,600 bps. The 16-Kbps compression algorithm is now used for normal voice recording, and 9,600-bps compression is used for recording voice-over data. The original release of the product used 9,200-bps for both. In addition, the company also reduced the price of MultiModemPCS hardware and MultiExpressPCS software from \$1,149 to \$949. 800-328-9717.

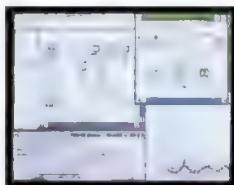
Cardinal Technologies Inc. recently reduced prices across its entire line of modems. The reductions are a response to recent cuts in pricing from U.S. Robotics and Hayes. In the 14.4-Kbps line, Cardinal reduced the 14450V32bis modem to \$239, the MVP144 internal fax/modem to \$229, and the MVP144 MAC to \$269. Cardinal also plans to introduce a new line of pocket modems as well as 19.2-Kbps Vterbo modems in conjunction with AT&T. 717-293-3000.

Ameritech's Wireless Field Express service is a new modem pool service that allows transmission of data over a cellular network without the need to change the modem technology at the host computer site. This new service allows mobile users to connect a laptop or other data device to any system or service that provides dial-up service and send data transmissions over a cellular network. The service is currently available in Chicago, and Ameritech plans to expand to other sites by the end of the year. The Wireless Field Service supports the Microcom Network Protocol 10 and will support AT&T's Enhanced Throughput Cellular protocol in the near future. 800-662-4531.



**With NAT's network management system,
you can do something about those traffic snafus.**

When you're managing mammoth amounts of information on the network, the last thing you need is a ponderous system jamming your traffic. With the LANB/450 Remote EtherMeter® and NMS/100 Network Management System software, you'll have the most cost-efficient solution available for controlling your busiest LANs.



NMS/100 3.0 Software
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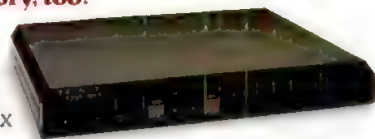
If a device changes its IP address or attempts to use an existing address, you'll know about it. If a new device gets on the net, you'll get an SNMP trap message. And if you'd like to keep a record of all this activity, the EtherMeter has a mighty 486/33MHz processor for configuring, filtering, and storing multiple host/matrix tables.

Drive the network from your PC. Don't get stuck with one of those complex, overpriced management stations. NAT's system lets you control the network from your Windows®-based PC, without sacrificing important standards like SNMP and RMON.

Get unwanted visitors off your highway. Advanced network security features will keep you in the driver's seat. If a device changes its IP address or attempts to use an existing address, you'll know about it. If a new device gets on the net, you'll get an SNMP trap message. And if you'd like to keep a record of all this activity, the EtherMeter has a mighty 486/33MHz processor for configuring, filtering, and storing multiple host/matrix tables.

It has a great memory, too.

Actually, the EtherMeter has two kinds of memory: up to 4MB of RAM for storing multiple host/matrix tables of up to 64,000 entries, and a half meg of non-volatile flash memory for downloading future enhancements. Hey—any system that keeps its hands off your PC's RAM and protects your investment in hardware deserves your respect (or at least a demo).



LANB/450 Remote EtherMeter
Plug-and-play Ethernet probe
Starting at \$2,595
Optional NAT support packages manage the EtherMeter using SunNet® Manager, POLYCENTER® OpenView® and NetView® stations

Move over, big boys. Network Application Technology has an unbeatable combination for efficient network analysis at the lowest cost per feature in the industry. In fact, in recent *CommunicationsWeek* product testing, NAT's EtherMeter and NMS/100 emerged as true price/performance leaders, stomping on other vendors' pricey probes and even charging past high-end UNIX® stations. So maybe you can't do much about your commute, but you can get your network traffic under control with a quick phone call to NAT. We'll put you on the fast track.

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CIRCLE 864 ON READER SERVICE CARD

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It's your choice. A little more than 50 percent of all business software in use today is pirated.

You might save a few bucks on it—but when phony software doesn't work, forget calling for product support. When it infects *your* computer with a deadly virus, it'll be your work that gets lost. The documentation is nonexistent or inadequate, so that won't help. And, of course, there will never be any product upgrades.

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Super Servers, Super Choice?

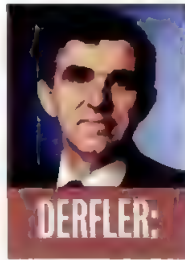
David, you are usually so in love with exotic technologies that I am surprised to see you supporting a pragmatic approach to servers. But I am so impressed with some of the high-end server hardware that I think these boxes are worth their slightly higher prices.

There are over 20 companies that are currently selling what I consider "super-server" hardware. My definition of "super server" begins with the unit's ability to accomplish symmetrical multiprocessing under either Microsoft Windows NT or Unix. In addition, a super server should take good advantage of error checking and correcting (ECC) memory, it should offer redundant power supplies, and it typically uses RISC processors in order to enhance disk I/O channels. Compaq's Proliant, for example—with its TriFlex architecture, a 128-bit memory bus, a 32/64-bit processor bus, and an EISA bus—seems to combine both good engineering and practicality. I would automatically disqualify any machine that uses a DX/2 clock-doubling processor, though, because it performs I/O processing at half-speed on anything with the ISA bus.

IBM's Parallel Network Array put LAN adapters inside the cabinet on hot standby—a great fault tolerance feature. IBM, Compaq, Dell, NetFrame, and other companies offer remote management and fault-notification systems that make it easier for network managers to sleep at night.

To be fair, super-server motherboards are complex, and they still represent potential points of system failure. But that's precisely why I appreciate the quality assurance and quality control that manufacturers have to put into these products—even though you ultimately wind up having to pay for those things.

IBM has demonstrated that devices such as the IBM PS/2 Server 195, for example, can handle more than 400 busy clients running under NetWare 3.11, and other super-server companies have shown similar performance. Sure, Dave, you can say that people don't need that kind of performance. But once they get it, it's like potato chips. They just can't stop. With starting prices that are comfortably below \$20,000, modern super servers are the right file servers at a reasonable price.



DERFLER:

I'm so impressed with some high-end servers that I think they are worth their slightly higher prices.

I must say, Frank, that I find it humorous that you call the Compaq Proliant a "super server." There's no question that the Proliant is a powerful server. But just a few years ago, the Proliant would have been called a souped-up PC. Now it's a super server? Times change.

The super servers of old had proprietary high-speed backplanes, integrated management, oodles of reliability features, and a hefty price tag to boot. These days, such features can still be found in the best of them: NetFrame's NF line of multiprocessing file servers.

And it's exactly those devices that I think no longer make the same sense. Using a proprietary bus so that you can connect peripherals, cluster CPUs, and increase I/O sounds like a great idea. But who needs the proprietary bus when both

Compaq and Tricord can offer you a fast I/O subsystem and still provide you with a standard expansion bus to connect other peripherals?

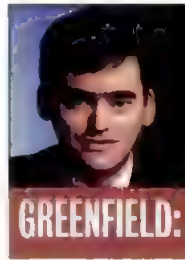
As for the IBM 195, I think it is a great buy, but for which segment of the market? Most workgroups contain way below 400 users. In fact, they average somewhere between 30 and 50 users.

Do you really need a super server to handle 30 to 50 users? Clearly not. What you want is a very reliable ruggedized PC with all the management features that you can get in a super server.

With the built-in management facilities of most network operating systems, the existing slew of proprietary network management packages, and the emergence of the Simple Network Management Protocol (SNMP) as the dominant networking standard, the functionality you obtain with high-end super servers is often superfluous.

You can be beeped if a server goes down, and then you can dial into that server and reboot it. You can monitor the server's status remotely through standard hardware and software. Symmetrical multiprocessing, RISC processors to improve I/O! Frank, what you've prescribed here is serious overkill.

So Frank, if you're hunting for a server, make sure it's got the entry price of a PC with the standard architecture that you need to manage your real workgroup, and not some theoretical one.



GREENFIELD:

What you want is a very reliable ruggedized PC with all the management features you can get in a super server.

Compaq and Tricord can offer you a fast I/O subsystem and still provide you with a standard expansion bus to connect other peripherals?

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Changing the Date Format

An Easy Menu System

BY NEIL J. RUBENKING

CHANGING THE DATE FORMAT

As an "internationalist" for many years, I find the confusion that results from the difference between the American date system and the system used in other countries annoying. In the U.S., 1/12/92 means January 12, but in many other countries, it means December 1. I think the best date format is YY-MM-DD, in descending order of importance, because it's easy to sort in database applications.

Although I'm still really a computer novice, it struck me that most ways I've seen to get a YY-MM-DD date format are unnecessarily convoluted. A better solution lies in the COUNTRY= specification you can include in CONFIG.SYS. Adding the line

```
COUNTRY=002,850,C:\DOS\COUNTRY.SYS
```

selects the Canadian-French format for date and time. A \$d in my PROMPT string now shows the date as 1993-01-31, and the DIR command displays file dates in the form 93-01-31.

This idea may not work for everything, but it is a much simpler approach.

*Charles Semple
Los Angeles, California*

► **PC MAGAZINE:** Way back in Version 3.3, DOS introduced support for international keyboard layouts and character sets, along with date, time, and currency formats. However, most of us in the United States have probably never used the internationalization commands. As shown here, a simple COUNTRY= line in CONFIG.SYS can change the format for the date and time used by DOS. (If you look over the table of countries and date/time formats in your DOS manual, you'll see that the U.S. format is the *only*

one that uses month, day, year order!) Note that besides setting the date to a YYYY-MM-DD format, it changes the time to a 24-hour format, with a comma separating the seconds and hundredths of a second. 1:00 pm would be 13:00:00.00

*Most of us in the
United States have
probably never used the
DOS internationalization
commands.*

instead of 1:00:00.00p.

The COUNTRY= line also specifies a *code page*—basically an alternative to the extended ASCII character set. The example COUNTRY= line above uses code page 850. This code page is named "Multilingual (Latin I)"; it differs substantially from the PC's usual extended ASCII character set, but adding the COUNTRY= line doesn't actually change your display.

If you want to experiment with *displaying* different code pages, you need to make a number of other changes in your configuration. First, add another line to your CONFIG.SYS to load the driver that allows EGA (or better) adapters to

use alternate code pages:

```
DEVICE=C:\DOS\DISPLAY.SYS  
con=(EGA,850,1)
```

Note that the number 850 matches the number in the COUNTRY= line. A table in the documentation for the COUNTRY= directive indicates which code pages can be used with which country code.

In AUTOEXEC.BAT, invoke National Language Support by calling NLSFUNC. Then prepare the console for the new code page by adding the line

```
MODE CON CP PREP=((850)  
C:\DOS\EGA.CPI)
```

Finally, add the command CHCP 850 to activate the code page. Now you'll see some changes in the extended ASCII characters. For example, hold down the Alt key, tap out 169 on the numeric keypad, and release Alt. You'll see the trademark symbol "™" instead of the right angle "∟". Your DOS manual has a complete list of the characters in the various code pages.

AN EASY MENU SYSTEM

My thorniest computer problem to date has been getting my family to use the computer. I didn't want to dump every program into the root directory for ease of access, or to install a dedicated batch file for each program. But my family vanished whenever I began talking about paths and filename extensions.

DOS's TREE command, plus a couple of small batch files, came to the rescue. Figure 1 shows our actual TREE menu. TREE with no parameters reports directory and subdirectory names, and each

► IN THIS SECTION

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application used by my family is placed in its own directory.

Figure 2 is the MENU.BAT file that displays the tree and invites the user to run a program. It gets called

- at the end of AUTOEXEC.BAT;
- at the end of the batch file that runs programs;
- any time you enter MENU at the command line.

Figure 3 shows RUN.BAT. When you enter RUN filename, the batch file checks that the named program exists, then switches to the correct directory and runs the program. Afterward it executes the menu again.

This has helped my family enjoy using the computer. In fact, I just bought my son his own computer, and he asked for my TREE menu utilities!

Clarence Cromwell
Westland, Michigan

► **PC MAGAZINE:** This tree menu system requires DOS 4.0 or better, because previous versions of the TREE command didn't produce the wonderful graphic representation of the directory tree. I've modified the basic system to make it even more inviting for the novice computer user. If you follow the setup procedure

TREE MENU DISPLAY

Type "RUN filename" to execute

```

|-----GAMES
|   |-----OUTRUN
|   |-----HANGMAN
|   |-----HUEY
|-----DESKTOP
|   |-----EIGHT
|   |-----PUBLISH

```

Enter MENU for tree menu
I:\>

Figure 1: This TREE-based menu system automatically lists all programs that have been installed following a few simple rules.

MENU.BAT

Complete Listing

```

@ECHO OFF
I:
CLS
ECHO Type "RUN filename" to execute
REM Character between quotemarks is ASCII 196
TREE \ | FIND "—"

```

Figure 2: MENU.BAT generates the display shown in Figure 1, prompting the novice user to run any of the listed programs.

RUN.BAT

Complete Listing

```

@ECHO OFF
I:
SET category=
FOR %%v IN (Games Desktop) DO IF EXIST \\%%v\%1\%1.* SET category=%%v
REM == To add new categories, change the list in parentheses ==
REM == in the line above, e.g. (Games Desktop Paint) ==
IF NOT '%category%'==' ' GOTO RunIt
ECHO "%1" not found. Type a name that appears on the tree menu.
PAUSE
MENU

:==== RunIt ====
CD \%category%\%1
SET category=
CALL %1
CD \
MENU

```

Figure 3: When you pass a program name to RUN.BAT, it seeks it in each specified category directory, then runs it and reexecutes MENU.BAT.

below, you can add new programs without any change to the menu system.

First, create a directory called FAMILY in the root directory of the C: drive. Decide what categories you'll use for your programs (the example in Figure 1 uses Games and Desktop) and create a subdirectory within C:\FAMILY for each category. Finally, for each program, switch to the appropriate category directory and create a subdirectory whose name is the same as the command with

which you invoke the program. For example, a game called HANGMAN.EXE would go in C:\FAMILY\GAMES\HANGMAN. Move the program and any ancillary files into this directory.

Make sure MENU.BAT and RUN.BAT reside in a directory that's on your PATH. Then add these lines to your AUTOEXEC.BAT:

```

PROMPT Enter MENU
for treemenu$_$p$g
SUBST I: C:\FAMILY
MENU

```

The SUBST command establishes the drive letter I: as an alias for C:\FAMILY. You can use any letter that's not already in use on your system. However, if the letter is F: or higher, you'll

have to add a LASTDRIVE= line to CONFIG.SYS, setting the last drive letter at least as high as the letter you want to use. If you use a letter other than I:, change the second lines of MENU.BAT and RUN.BAT to the new letter.

Using a SUBST drive for the programs on the menu makes it easy to hide programs. Anything in a directory that's not under C:\FAMILY simply won't show up!

MENU.BAT pipes the output of the TREE through the FIND filter, selecting only lines that contain ASCII character 196. That eliminates some of the unnecessary lines that are returned by TREE. Because MENU.BAT checks the actual tree every time, any new programs you add to the directory will show up automatically.

When you pass a program name to RUN.BAT, it looks for a matching directory and program in each of the category subdirectories. To modify RUN.BAT for your own categories, or to add a new category, just edit the list in parentheses in the fourth line. If RUN.BAT doesn't find a matching directory/program combination, it reports an error and reexecutes MENU.BAT. If it does find a match, it switches to the directory, runs the program, and then reexecutes MENU.BAT. RUN.BAT uses the CALL command to run the program just in case it's a batch file.

You can download both batch files from PC MagNet's Utilities/Tips forum archived as MENUS.ZIP. □



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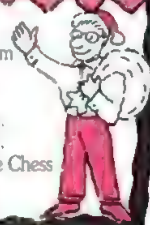
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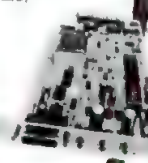
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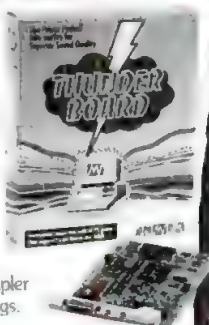


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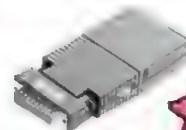


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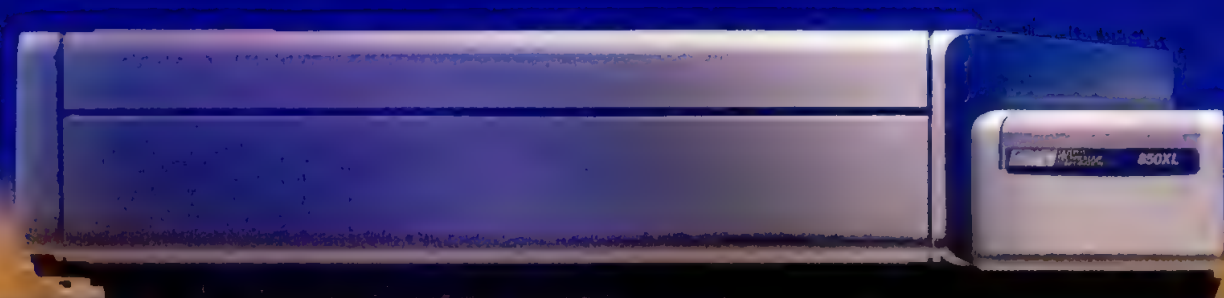
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DOS 6.0's DoubleSpace: Is It Safe?

BY JEFF PROSISE

On March 30 of this year, Microsoft introduced integrated disk compression to the masses with MS-DOS 6.0 and DoubleSpace. Disk compression had been around for years in the form of add-on products such as Stac Electronics' Stacker, but DoubleSpace was the first such compression product to forge an intimate bond between the disk compression driver and the operating system. Prior to MS-DOS 6.0, there were just a few hundred thousand PCs equipped with disk compression. As of August 1993, approximately 10 million MS-DOS 6.0 upgrades and OEM packages have been sold, and Microsoft estimates that 60 percent of all MS-DOS 6.0 owners use DoubleSpace. With somewhere in the neighborhood of 6 million PC users now enjoying the benefits of on-the-fly disk compression, it's no wonder that integrated disk compression—and the question of whether it's safe to use—is at the forefront of the minds of many users.

The idea behind disk compression is simple: A special driver compresses data as it is written to disk and uncompresses it when it is read back, roughly doubling the disk's storage capacity. The actual compression ratios achieved depend on the compression algorithm and the content of the data that is being compressed. DoubleSpace uses the well-known LZ77 compression algorithm, which compresses data by replacing recurring character sequences with tokens identifying previous occurrences. With LZ77, some files can't be compressed at all. On the other hand, large bitmap files that don't use an internal compression algorithm often compress to a tenth of their original size. On the average, most hard disk users see about a twofold increase in the capacity of a drive whose files are compressed

using LZ77 or one of its variants. To learn more about compression algorithms, see the Tutor column in our issue of May 25, 1993, and the Lab Notes column in our issue of June 29, 1993.

This process of compression and decompression is performed entirely behind the scenes. To the user, the only substantial difference between a com-

*With about 6 million PC
users now enjoying
integrated disk
compression, it's no wonder
many users are concerned
about its safety.*

pressed and an uncompressed drive is the storage capacity. Compressed drives sometimes operate slower than uncompressed drives, but the difference is usually imperceptible. According to Microsoft, DoubleSpace drives are, on the average, 5 to 15 percent slower than non-DoubleSpace drives. In isolated cases, however, a disk compression product can actually speed up a drive. The reason: If the drive is slow to begin with, or if the compression ratio is sufficiently high, the time required to compress or uncompress the data could be more than offset by the lower volume of data being read or written. Another consideration in measuring the performance of compressed drives is that operations involving more reads than writes typically take less of a performance hit, because it takes less time to uncompress data than to compress it. And contrary to popular belief, DoubleSpace does not significantly degrade the

performance of database engines employing random reads. DoubleSpace does not have to read and decompress an entire file to locate a record near the end of the file.

Since MS-DOS 6.0's introduction in the spring, the trade press has printed scattered reports of disk failures and incidents of data loss due to DoubleSpace. One prominent trade weekly reported that DoubleSpace didn't work on more than half of its PCs, and warned readers to stay away from it. Integrated disk compression has been a hot topic at user groups around the country, with many rumormongers adding fuel to the fire by repeating unsubstantiated stories about bugs in DoubleSpace. Yet many of us have been running DoubleSpace for months now (or a competing product for years), and have yet to experience the first glitch. And the massive testing program that MS-DOS 6.0 underwent prior to its general release would seem to all but eliminate the likelihood of any major bugs. But the questions remain. Is disk compression safe? Do you put your data at risk by using it? Does DoubleSpace in particular pose a danger to your files? To answer these questions fairly and objectively, we'll begin with an explanation of how DoubleSpace works.

HOW DOUBLESAPCE WORKS In DoubleSpace, the data written to a compressed disk is stored in a special file called a *compressed volume file* (CVF), which is stored on an uncompressed (or *host*) drive and virtualized in such a way that it becomes a full-fledged logical drive. This sleight-of-hand is accomplished by the DoubleSpace driver DBLSPACE.BIN, which loads right after IO.SYS and MSDOS.SYS and assigns each CVF a drive letter. When you copy a file to a DoubleSpace drive, the file goes into the CVF that corresponds to that

drive. The maximum size that the CVF can be is 512MB, so the practical limit on the amount of data that can be stored on a compressed drive is about 1 gigabyte. This figure could vary, of course. If DoubleSpace managed a compression ratio of 1.5:1 for a compressed drive whose CVF size is 512MB, that drive would hold "only" 750MB worth of information.

The structure of a CVF, which is diagrammed in Figure 1, is similar to that of a logical DOS drive. The CVF's file allocation table (FAT) and root directory serve the same purpose as FATs and root directories on conventional drives. Just as in a conventional FAT, the CVF's FAT is limited to 64K entries. (Although most uncompressed drives contain a second copy of the FAT for safety, a CVF contains only one FAT; however, DoubleSpace virtualizes the CVF's FAT so that it appears that the compressed

drive contains two FATs.)

The FAT is a road map that specifies the clusters where individual files are stored. There is one FAT entry for every cluster on the disk. If a file is stored in clusters 10, 11, and 26, then FAT entry number 10 contains the value 11, FAT entry number 11 contains the value 26, and FAT entry number 26 contains a special end-of-file marker. Each FAT entry contains the number of the file's next cluster, forming an allocation chain that records the file's location on disk. FAT entries for unused clusters are equal to 0. The root directory contains filenames, starting cluster numbers, and other information pertaining to files and subdirectories stored in the drive's root directory.

In a CVF, the *sector heap* is where all file data written to the compressed drive is stored, and it is analogous to the data area of a conventional, uncompressed disk. Space on the logical drive is allo-

cated on a per-cluster basis, but space in a compressed disk's CVF is allocated on a per-sector basis. (The cluster size of a DoubleSpace drive is always 16 sectors, even if there's fewer than 16 sectors' worth of data.)

Data is *compressed* by the *cluster*. So, to sum up: Data storage space is allocated to files in 16-sector clusters, compressed by the cluster, and then stored by the *sector* in the sector heap.

Extra data structures in the CVF—the MDBPB, the BitFAT, and the MDFAT—hold information specific to compressed drives. The MDBPB, which is one sector in length, contains a standard BIOS Parameter Block (BPB) like the one found on every DOS-formatted disk, plus some additional information spe-

cific to DoubleSpace (the MD stands for *Microsoft DoubleSpace*). The BitFAT contains one bit for every sector in the sector heap, and keeps a record of which sectors are used and which are free. If a bit's value is 1, then the corresponding sector contains file data; if it's 0, then the sector is free. The MDFAT is a supplement to the FAT that correlates the clusters on the compressed drive with sectors in the CVF's sector heap. The MDFAT, like the FAT, contains one entry for every cluster on the compressed disk. Each MDFAT entry is 32 bits long and contains five fields: a *secStart* field that identifies the starting sector for the corresponding cluster (an offset into the sector heap); *csecCoded* and *csecPlain* fields that record the number of sectors required to hold the cluster in compressed and uncompressed form; an *fUncoded* field that specifies whether the cluster is compressed or uncompressed; and an *fUsed* field that indicates whether this MDFAT entry is in use. On a DoubleSpace drive, the cluster size is always 8K (16 sectors), so the *csecPlain* field always holds the value 16. Presumably (because the value of *csecPlain* is stored on-disk rather than assumed), this characteristic of a DoubleSpace drive could change in future versions of DoubleSpace.

Figure 2 illustrates a typical mapping of a compressed file in the CVF. Uncompressed, the file's size is 17,500 bytes, requiring three clusters (48 sectors) of storage space, even though only 35 of those sectors are actually used. The file is mapped to clusters 10, 11, and 26 on the compressed drive. On a normal drive, a physical sector number can be computed directly from the cluster number. On a compressed drive, a physical sector number can be computed from a cluster number only by consulting the MDFAT. In this example, the MDFAT shows that the file data for cluster 10 is actually stored in sectors 96 through 104 (*secStart*=96, *csecCoded*=9). This represents a compression ratio of almost 2:1 for this portion of the file, because this cluster originally occupied a full 16 sectors (*csecPlain*=16). Tracing the MDFAT entries for clusters 11 and 26 shows that cluster 11 is stored in sectors 180 through 187, and cluster 26 in sectors

The Structure of a CVF

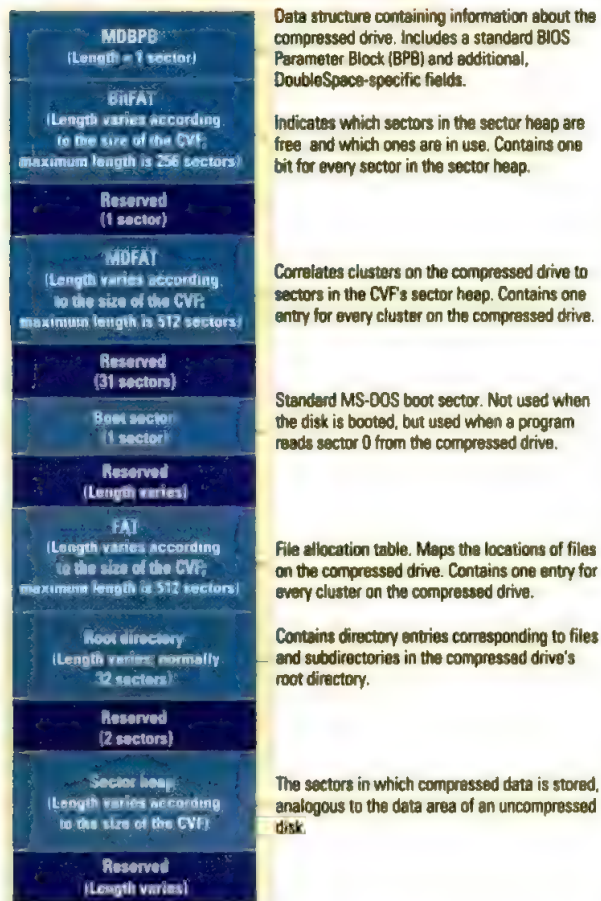


Figure 2: MS's DoubleSpace utility creates a file with this format to keep track of and store compressed file data.

How a File Is Stored on a DoubleSpace Disk

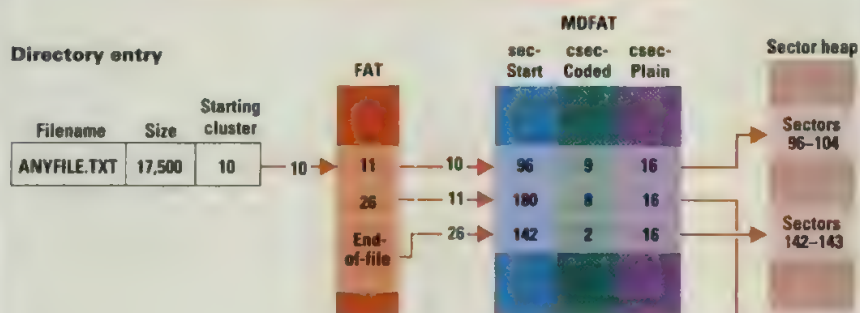


Figure 2: The ANYFILE.TXT file is located in two ways: logically in clusters 10, 11, and 26, and physically in sectors 96-104, 142-143, and 180-187. The MDFAT provides the translation between these two systems.

142 through 143. The compressed file requires only 19 sectors of disk space, a savings of nearly 60 percent. Note that the *csecPlain* field in the MDFAT contains the value 16 for each of the file's cluster entries even though they actually use fewer than 16 sectors, because DOS would normally set aside a full cluster of physical disk space for this file.

This example graphically illustrates the two ways in which DoubleSpace conserves disk space. First, file data is compressed using LZ77 on a cluster-by-cluster basis so that it requires fewer sectors of storage space. Second, since disk space is actually allocated in sectors rather than clusters (despite the illusion that space is still allocated on a per-cluster basis), the unused space between the end of a file and the end of the file's last allocation unit is reduced. On the average, this alone results in a savings of nearly 4K per file, or about half the difference between an 8K cluster size and a 512-byte sector size. And the savings obtained by reducing the base allocation unit size is achieved on every file—even files that are a mere 1 byte in length.

Figure 2 also illustrates why running pre-MS-DOS 6.0 defragging utilities on a compressed drive doesn't completely defragment the drive. Because of the way space is allocated on a compressed drive, a file can be stored in contiguous clusters yet still be fragmented in the sector heap. Newer defraggers, such as the one shipped with The Norton Utilities, Version 7.0, defrag a drive more thoroughly

by defragging the sector heap as well. MS-DOS 6.0's own DEFRAG command doesn't defrag the sector heap but does compact it, moving all used sectors to the front of the sector heap and unused sectors to the end. This reduces the debilitating effect that fragmented files have on a disk's performance, but not to the same extent as a full defragmentation.

BUT IS IT SAFE? Is DoubleSpace—and disk compression in general—safe? First, let's dispel some of the rumors. To date, Microsoft has found no bugs in DoubleSpace. There were some stack overflow problems early in the beta process that affected about 2 users out of 100, but these problems were corrected long before MS-DOS 6.0 was released. Soon after the release, Microsoft dispatched technical teams to several sites that reported DoubleSpace-related disk failures. The chief problem causing compressed disks to fail was that disks contained defective sectors in the areas where important data structures, such as the MDFAT, were created. The bad sectors were there before DoubleSpace was installed, but they previously fell within the disk's data area. DOS can work around defective sectors in the data area, but such problems pose a graver danger in the system area.

One of the most common criticisms leveled at DoubleSpace, and at disk compression products in general, is that inadvertently deleting one file (the CVF) can lose an entire disk full of files. And it's true. Deleting the CVF is equiv-

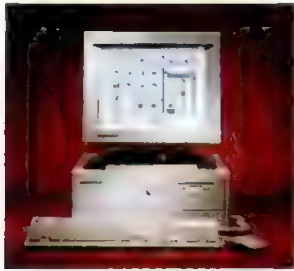
alent to deleting every file and subdirectory on an uncompressed disk. This is perhaps the greatest risk in using compressed drives. MS-DOS 6.0 protects CVFs by marking them *hidden*, *system*, and *read-only*, but it's still all too easy to erase a CVF. The safest strategy is to avoid using the host drive directly. This means that you might want to avoid using the DoubleSpace option that creates a compressed drive from the free space on an uncompressed disk, because doing so mixes the CVF in with normal, uncompressed files. Allow DoubleSpace to use all of the host drive for the CVF, and you can pretend that the host drive no longer exists.

Another risk is that compressed disks contain more critical regions than uncompressed disks—critical regions that, if corrupted, could render the disk unusable. With a conventional disk, a bad sector anywhere in the FAT or boot sector is bad news. With a compressed disk, a bad sector in the host drive's FAT, in the CVF's FAT, or in the BitFAT or MDFAT could render the disk unusable. Fortunately, these areas constitute only a small fraction of the total capacity of a typical disk, so the risk is still very small.

What about the reports from a well-known trade weekly soon after MS-DOS 6.0's release that DoubleSpace littered its hard disks with cross-linked files? It turned out that many of these problems were not reproducible. Other problems were not caused by DoubleSpace, but by the lab technicians' use of a software reboot utility that neglected to flush DOS disk buffers before rebooting. MS-DOS 6.0's setup program automatically installs SMARTDrive, and the MS-DOS 6.0 version of SMARTDrive uses deferred writes to improve disk performance. Mix the two—a software reboot utility that doesn't flush the cache, and a disk caching program that caches writes for up to several seconds before physically committing them to disk—and trouble is sure to result. Whose fault was it? Perhaps the setup program should not install SMARTDrive automatically. (I could then imagine reviewers saying, "Shouldn't SETUP at least install SMARTDrive for you?") Or perhaps professional hardware testers should be

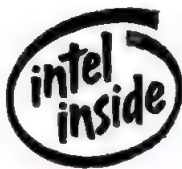
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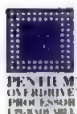
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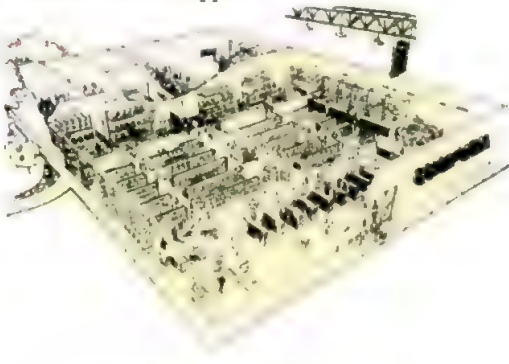
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more careful to know and understand the environment in which they're testing, and less hasty to publish (inaccurate) conclusions. You be the judge.

Microsoft has taken several steps to alleviate DoubleSpace-related problems in MS-DOS 6.2, which is scheduled for release this fall. Among other things, DoubleSpace will now scan (and sometimes repair) disk defects that could interfere with important data structures such as the MDFAT. A new technology called DoubleGuard will verify the integrity of critical DoubleSpace data structures so that DoubleSpace will not crash if other programs write into its buffers. Part of the MS-DOS 6.2 version of DoubleSpace will load in the high memory area (HMA) if the BUFFERS setting in CONFIG.SYS is sufficiently small, reducing DBLSPACE.BIN's footprint in upper or conventional memory. A new uninstall utility will also make it easy to remove DoubleSpace from a disk. These and other enhancements (including a new version of SMARTDrive that caches CD-ROM drives as well as hard and floppy disk drives) promise to make 6.2 a better DOS than 6.0.

A WORD TO THE WISE That's not to say that integrated disk compression is, or ever will be, risk-free. No magnetic storage device is risk-free, and adding a compression layer on top of an already complex file-system interface compounds the risk. Given the endless variety of hardware in the PC marketplace, the complexity of disk compression software, and the unprotected memory space in which DOS and its application programs run, there will always be incidents of incompatibility. Any software developer with experience in the DOS arena will confirm how problematic the DOS environment can be. To be safe, back up your hard disk before installing a disk compression product. Then test a compressed disk thoroughly before committing mission-critical files to it, and continue to back it up at regular intervals as you would an uncompressed drive. If the compression product works fine at the start, and if you're careful to avoid damaging the underlying components of the compression system, then chances are that you'll be well served by disk compression for the life of your drive. □

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Writing Your Own NetWare Loadable Modules

BY BARRY NANCE

Your NetWare file server can do more than simply deal out files and provide print services to the workstations on your LAN. By running NetWare Loadable Modules (NLMs) on a NetWare 3.11 or 4.0 server, you can avoid network traffic jams, make use of otherwise idle server CPU cycles, and centralize processing activities that would otherwise require hardware too expensive to duplicate at each workstation.

In this Lab Notes, you'll find out how to write your own NLMs. For this purpose, as an instructive example, I'll present code for the kind of NLM software you might use to add an e-mail-server function to your NetWare environment. Though its code will compile, the small EMAILNLM.NLM I'll discuss is not really intended as a finished utility, such as might appear in the Utilities column of this magazine. EMAILNLM.NLM represents a distinctly no-frills approach, and it does not include the workstation software for the other end of the cable. You have to write the workstation software and add any refinements you want. And, as with any NLM software you write, the warning can't be too often repeated that you should always test, test, test before unleashing it on your production network. Errant NLMs can eat servers for breakfast, and the indigestion that can result is severe.

Don't let these warnings deter you, however. It's still worthwhile to develop an NLM. If you have many workstations constantly reading or writing a few large files on the server, the LAN traffic to and from those workstations can bog down your network. Instead of requiring each workstation to issue megabytes worth of read requests to search for important in-

formation, you might develop an NLM that does the search operation directly inside the file server and returns the information to the workstations over the LAN cable, using a communications protocol such as IPX. A workstation could send a single LAN packet to your NLM to request information and, in return, expect one or several packets from your NLM once it has done its job.

Moreover, NLMs can centralize such LAN functions as tape backup, database

*Use your Novell file
server to accomplish
a much wider variety of
processing tasks.*

retrieval, network management, or e-mail post office facilities. Via an NLM, you can also use spare CPU cycles on your NetWare file server PC to do application processing on your LAN. Are such spare cycles available? Most high-end 486- (and now Pentium-) based NetWare servers have plenty. The server often expends most of its efforts accessing the hard disk(s) and network adapter(s), leaving the CPU to wait on these relatively slow I/O devices. An NLM can thus use some of the CPU processing power of an otherwise idle server CPU.

WHAT IS AN NLM? NLMs are pretty much like ordinary computer programs, so you shouldn't shy away from NLM development just because you run your program on a file server instead of a workstation. In fact, writing NLMs is in some ways simpler than writing DOS or Windows programs. An NLM runs in protected mode in a flat, 32-bit memory model, for example, so you don't have to

concern yourself with segments, offsets, and 64K limitations. There are, however, two significant considerations you need to bear in mind before you start programming NLMs.

First, note that NetWare 3.11 and 4.0 give your NLM a cooperative, non-preemptive processing environment. Unlike preemptive environments such as OS/2 (running Lan Server or LAN Manager, for example), Netware does not have any built-in means of interrupting one task in favor of another. This approach has advantages and disadvantages. NetWare itself remains simpler because it doesn't have to handle the scheduling and dispatching of tasks in the computer. But it also means that NLM developers must take the responsibility of preventing the NLM from monopolizing the CPU.

Specifically, your NLMs must be written to relinquish control of the CPU periodically so as to give other processes a chance to run. Fortunately, the responsibility isn't an awful burden if you're mindful of the file-server environment in which your NLM will run. In fact, opportunities for NetWare to "take a breath"—that is, to process file I/O requests from workstations—occur automatically when your NLM calls I/O functions to open, read, write, or close files, or when you send and receive messages to and from workstations. For example, the `IpxSend()` call (discussed below) not only transmits a response message to a workstation but also gives NetWare a chance to process any outstanding file, print, or login/logout requests.

Secondly, NetWare doesn't offer the kind of virtual memory management that an operating system such as OS/2 provides. OS/2 can overcommit memory by swapping not-recently-used pages of memory to a disk file. With NLMs, how-

ever, you can't allocate or use more memory than physically exists in the file server. That means you must ensure that there's enough RAM in the server for both NetWare and your NLM.

A NetWare Loadable Module has an extension of .NLM, .DSK, or .LAN, rather than the familiar .EXE or .COM. It runs in a NetWare 3.11 or 4.0 file server and uses the same memory, hard disk, network adapter, and library functions that NetWare itself does. In fact, as documented in its manuals, NetWare uses several NLMs. The NE2000.LAN file provides support for NE-2000 (and compatible) network adapters, for example. The TOKEN.LAN file supports IBM Token Ring adapters. The PS2SCSI.DSK file lets NetWare use SCSI disks on PS/2 computers. The MONITOR.NLM executable displays file server status information, and the PSERVER.NLM file gives a file server the ability to also act as a print server. You can find these and other examples of NLMs by changing to the SYS:SYSTEM directory from any workstation and using the DIR command to look for files with .NLM, .DSK, and .LAN extensions.

At a NetWare file server console, you can use the LOAD and UNLOAD commands to start and stop NLM programs. An NLM can also, at its option, unload itself from memory (terminate) when it has finished processing. This ability to load and unload NLMs while the server is still running is what makes NLMs under NetWare 3.11 and 4.0 so powerful and easy to use. (Although the NetWare 2.2 environment had a similar type of server program, called a *value-added process*, loading and unloading a VAP required you to stop and restart the file server.)

EXAMPLES OF NLMs Recognizing that you may not want to buy a separate PC on which to run their software, a number of commercial vendors of LAN-based software supply NLM versions of their products. In many cases, an NLM is a natural place to perform central LAN functions; in others, using an NLM is the only way the vendor can give you the functions and features of his product.

Oracle Corp. and Sybase, for example, offer NLM versions of their database managers that process database queries in the file server. Workstations issue

Structured Query Language (SQL) requests to these NLMs directly through the LAN cable, without having to open/read/write/close files. The NLMs themselves access the tables and rows of the database by performing file I/O operations inside the server and then return just the requested information (the result of a SELECT query, for example) over the wire to the workstation.

Novell itself provides a tape backup NLM (SBACKUP.NLM) with the NetWare 3.11 network operating system to let you make backup copies of files on the server (assuming, of course, that your file-server PC has a tape drive attached). Novell also bundles its BTRIEVE file access method in the form of an NLM that comes with the NetWare 3.11 NOS. And Frye's LAN Directory network manage-

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ment product uses an NLM to monitor the health of a NetWare 3.11 file server. All of these products are good examples of what you can do with NLMs.

WHAT DEVELOPERS NEED Novell supplies libraries of functions your NLM program can use to perform its work. These functions allow NLMs to read and write files in the NetWare file system, communicate with workstations through the LAN cable, perform calculations, and do other types of information processing. With these library functions, your NLM can allocate memory, spawn multiple processing threads, and advertise its presence to workstations on the LAN. The functions can also enable an NLM to read and write objects in the NetWare Bindery, perform login/logout operations, create, change, or remove directories, add items to a NetWare queue, and become

a queue processor/server. An NLM can even access files in a DOS partition on the server's hard disk or access Macintosh files and their name spaces by means of the AppleTalk Filing Protocol (AFP).

The CLIB NLM is particularly important to developers because it contains the vast majority of the functions an NLM will need to call. You link at compile time with a CLIB import library and, at the file-server console, you load the CLIB NLM before loading and running your own NLM. Other NLMs can also use the services and functions in CLIB. The mechanism within NetWare for accessing CLIB and other NLM libraries works very much the same way that Dynamic Link Libraries (DLLs) work in the Windows and OS/2 environments.

To compile and link your NLM, you'll need the Watcom 32-bit C compiler product (now at Version 9.5). Other compilers, such as those from Microsoft, Borland, or Symantec, or even IBM's 32-bit C Set/2, simply won't do. These other compilers either don't produce 32-bit code or can't crank out an executable file in NLM format. You can purchase the Watcom 32-bit compiler direct from Novell, together with the appropriate technical reference manuals for NLM programming, as the Network C for NLMs Software Developer's Kit (NLM SDK). Further information from Novell can be obtained by calling 800-453-1267.

You'll need some additional reading material as well to help you get up to speed in NLM development techniques. Novell's Developer Support Group in Austin, Texas, publishes a set of technical reference manuals for NLM developers, as well as the *Bullets* newsletter. The phone number is 512-346-8330. Novell Research puts out *NetWare Application Notes*, which often contains useful information about NLM development. And Novell Press publishes the book *NetWare 4.0 NLM Programming* by Day, Koontz, and Marshall to help you get started. Much of the information in this volume applies to NetWare 3.11 NLMs as well as to 4.0 NLMs. On the client (workstation) side, let me immodestly suggest my own book, *Network Programming in C* (Que, 1990), for help in creating workstation software that communicates with NLMs.



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EMAILNLM.NLM

Partial Listing

```

/* login as user MAILBOX, password EMAIL */
if (LoginToFileServer("mailbox", OT_USER, "EMAIL")) {
    printf("Could not login as MAILBOX. Aborting.\n");
    return 1; }

/* change to the SYS:\MAILBOX directory */
if (chdir("SYS:\\MAILBOX")) {
    printf("Could not change to MAILBOX directory. Aborting.\n");
    return 1; }

/* open socket 0x4545 */
Socket = 0x4545;
IpxOpenSocket(&Socket);

/* register an atexit() function to happen at unload time */
atexit(MailUnload);

```

Figure 1: The code above shows the initial steps taken by EMAILNLM.NLM.

THE POST OFFICE NLM To demonstrate the techniques of NLM programming, I've written a small NLM that serves as a central post office for simple store-and-forward electronic mail functions. E-mail is a perfect opportunity to exploit the features and advantages of NLM technology. While other e-mail products work by reading and writing files in a post office directory on the server through redirected open/read/write/close I/O calls, EMAILNLM accesses its post office directly at the file server. EMAILNLM receives outgoing mail through the LAN cable, using IPX, and it stores mail items in a MAILBOX directory on the server. When a workstation wants to read a mail item, it sends an IPX message packet to the e-mail NLM. The NLM then delivers the mail item, as a series of LAN packets, to the workstation.

You can download the executable as well as the complete source code for EMAILNLM from PC MagNet's Programming Forum. It is archived as EMAIL.ZIP. I'll give you some pointers on how you can customize and enhance the post office NLM later in this article.

SETTING UP YOUR E-MAIL SERVER Before loading the EMAILNLM.NLM for the first time, a person with supervisor rights must run the SYSCON utility to establish a log-on account named MAILBOX with a password of EMAIL. You can, of course, change these values in the NLM, recompile, and change your installation procedures accordingly if you want to maintain secrecy and security. Since NetWare is sold for groups of 20

or 100 workstations, using up one account should not be of overriding concern.

On the SYS: volume of a test network on which you can safely check things out, create a directory named MAILBOX. In SYSCON, give the MAILBOX account all rights to SYS:MAILBOX and make sure no one else has rights to the directory. Only the NLM will access files in the MAILBOX directory.

Copy the EMAILNLM.NLM file to the SYS:SYSTEM directory. Use the command LOAD EMAILNLM at the file-server console to load the software. You can put this command in your AUTO EXEC.NCF file if you want the software loaded automatically each time you start the server. You may even want to make the SYSTEM directory off-limits from prying eyes. (As currently coded in this illustrative example, the password is a piece of text within the executable file and thus easily found with a file viewer.)

Note that this EMAILNLM.NLM relies on NetWare's own security mechanisms to ensure message privacy. The special logon account MAILBOX and people with supervisor-equivalent rights are the only ones who will be able to access mail message files in the MAILBOX directory. As you customize and enhance the e-mail NLM software, it should be easy for you to preserve the privacy of electronic mail in your organization. If you decide to use the EMAILNLM.NLM program without modifying it, you'll want to keep the log-on account and password secret and perhaps coordinate peri-

odic recompiles of the software with the network administrator so you can change the password on a regular basis. (A better practice would be to set up the code so that a supervisor could e-mail EMAILNLM.NLM to change the password, encrypting it by setting the top bit before saving.)

HOW EMAILNLM WORKS The e-mail Server program does for e-mail requests from workstations what NetWare itself does for file I/O requests from workstations. Workstations use IPX to send mail-request messages to the post office NLM; the NLM responds by delivering the mail or taking some other requested action. The workstation software, which you must write, sends and receives IPX messages in a particular format to interact with EMAILNLM. This C struct defines the format of mail message packets both sent and received by the NLM:

```

struct {
    char    ActionCode;
    short   MailID;
    short   Sequence;
    char    LastPacketFlag;
    short   Length;
    short   Reserved;
    char    Packet [500];
} Message;

```

The ActionCode field within the mail message itself specifies the operation that the NLM should perform:

ActionCode	Response
1	List mailbox items
2	Read message
3	Delete message
4	File outgoing message for delivery

EMAILNLM begins by logging in, preparing to receive IPX messages, and indexing any mail items in the post office. As the NLM receives LAN packets from workstations, it manages the files in the MAILBOX directory, with each file a mail item. The NLM can return a series of LAN messages to the workstation, each being an item in the person's in-/out-basket. The NLM can open a file on behalf of the workstation and send the contents of the mail item as a series of IPX LAN messages. The NLM can also delete

a mail item. And, on receipt of a request from a workstation, the NLM can create, write, and close a new outgoing mail item in the MAILBOX directory.

When the e-mail NLM begins running, it performs a NetWare LOGIN function with the default account name of MAILBOX and a password of EMAIL. (As mentioned above, you can change these in the source file and re-compile.) The NLM then does a change-directory operation to the SYS:MAILBOX directory. After opening an IPX socket (0x4545) for sending and receiving mail-request message packets, the NLM registers an atexit() function. If you issue an UNLOAD EMAILNLM command at the file-server console, the registered atexit() function logs out and closes the IPX socket. The C code fragment listed in Figure 1 shows how these initial steps are accomplished.

Note below that the MailUnload() function—the registered atexit() function—is responsible for clean-up operations, ensuring that the NLM does not leave a residue of still-allocated NetWare resources inside the server.

```
void MailUnload(void) {
    Logout();
    IpxCloseSocket(Socket); }
```

Before processing any mail requests from workstations, the NLM creates an in-memory index of all the files in the MAILBOX directory. The program opens each file, stores information from the file's first record (the mail header) in an in-memory array, and closes the file. The following C structure shows the layout of the mail header; the From, To, Date, Time, and Subject items should bring to mind standard interoffice mail:

```
struct MailHeaderType {
    char From [50];
    char To [50];
    char Date [10];
    char Time [10];
    char Subject [50];
    char Reserved [4];
    char FileName [15]; };
```

The FileName item in this struct is where the e-mail NLM remembers the name of the file as the software creates

the index of files in the MAILBOX directory. (With a slightly different design, the program could process the mail headers of all the files each time a workstation sends a mail-request message. However, I feel the NLM would give faster response times if the NLM maintained an internal list of outstanding mail items.)

After indexing any outstanding mail, the NLM is almost ready to begin processing new mail requests from workstations. Because the NLM uses the IPX protocol to send and receive workstation mail requests, the EMAILNLM.NLM issues the "Listen ECB" shown in Figure 2 to the file server's IPX message handler.

When an IPX message packet containing a socket value of 0x4545 arrives at the file server, the IPX message handler gives the packet to the e-mail server NLM. Before it inspects the message packet's Action Code and performs the indicated operation, the NLM asks NetWare for the account name of the person logged in at the requesting workstation, using the GetUserNameFromNetAddress() function:

```
GetUserNameFromNetAddress((BYTE *)
    IpxHeader.sourceNet, 0, &User);
```

To ensure mail privacy, the NLM will read mail only on behalf of the person actually logged in at a workstation. Once it has verified the workstation's identity, the NLM can inspect the message packet's Action Code and perform the indicated operation. Typically, the first of these is a List Mailbox Items request (ActionCode 1), which must precede a Read Mail (ActionCode 2) or a Delete Mail (ActionCode 3) request.

For a List MailBox Items request,

EMAILNLM searches its index and responds with a list of in-basket and out-basket mail items for the particular user account. The returned list contains an identifying number for each mail item (the MailID field in the Message struct). The workstation might receive one or several messages from the e-mail NLM, with each message corresponding to an in-basket or out-basket mail item. The last item in the list has a field (LastPacketFlag) set in the message packet that helps the workstation know whether to issue further IPX receive operations.

Unlike session-based protocols such as SPX and NetBIOS, datagram-based protocols such as IPX don't guarantee delivery of LAN packets. As a result, your NLM software must be written to detect and handle missing packets. To do this, EMAILNLM inserts a sequence number into each packet so that the workstation can know whether it has received a complete set of responses from the NLM.

Inside the Packet field of the Message struct, the NLM builds the MailHeaderType struct mentioned above. The complete list of returned mail header items is shown in Figure 3. It contains enough information for the workstation to display a useful selection of in-basket and out-basket items and for the workstation to ask the NLM to read one of the items on the workstation's behalf.

When a workstation sends the Action Code of a Read Mail request, together with the identifying number of that mail item, the NLM first checks to see that the logged-in person is entitled to receive that numbered mail item. The program then reads the requisite file in 500-byte chunks and uses the IPXSend() function

EMAILNLM.NLM

Partial Listing

```
/* issue a Listen ECB */
IssueListen:
    memset(&EventControlBlock, 0, sizeof(EventControlBlock));
    memset(&IpxHeader, 0, sizeof(IpxHeader));
    memset(&Message, 0, sizeof(Message));
    EventControlBlock.fragCount = 2L;
    EventControlBlock.fragList[0].fragAddress = &IpxHeader;
    EventControlBlock.fragList[0].fragSize = sizeof(IpxHeader);
    EventControlBlock.fragList[1].fragAddress = &Message;
    EventControlBlock.fragList[1].fragSize = sizeof(Message);

    IpxReceive(Socket, &EventControlBlock);
```

Figure 2: The "Listen ECB" message is required by the IPX protocol.

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to send each block of mail messages to the requesting workstation. The last IPX packet contains a flag (LastPacketFlag) that tells the workstation the mail delivery is complete. In the Packet field of the first block, the NLM stores the mail item's header (envelope) information. The NLM uses the Packet field for each subsequent block of data from the file for that mail item.

The process operates in reverse when the workstation software asks the e-mail server NLM to deliver an outgoing mail item. When EMAILNLM receives an item with ActionCode 4 (File outgoing message for delivery), it puts the mail header of the new item into the in-memory index of outstanding mail and creates a file that will contain the mail item in the MAILBOX directory. The workstation then sends as many 500-byte packets to the NLM as necessary to transfer the mail item to the server. The transmission ends when EMAILNLM receives a packet whose LastPacketFlag is set. The mail item then sits in its file in the MAILBOX directory until the intended recipient retrieves it through the List Mailbox/Read Mail operation described above.

When the e-mail NLM receives an IPX message packet from a workstation with an Action Code saying "Delete This Mail Item," the identity of the person making the request is verified as the original recipient. The NLM then simply deletes the file and removes the mail item's in-memory index entry.

COMPILING AND DEBUGGING Once you've installed the Watcom compiler at a DOS or OS/2 workstation and set a couple of environment variables (as explained in the Watcom User's Guide

```

NEWTHREAD.C
Partial Listing

/* open a dynamic socket for each thread */
ThreadSocket = 0;
IpxOpenSocket(&ThreadSocket);
SocketTable[SocketCount++] = ThreadSocket;

/* start a thread for this workstation */
BeginThread(WorkstationThread, NULL, 8192, &ThreadSocket);

/* tell the workstation the socket # it needs to use */
memcpy(&IpxHeaderOut.destNet, &IpxHeaderSave.sourceNet, 12);
MessageOut.ThreadSocket = ThreadSocket;
IpxSend(Socket, &EventControlBlockOut);

```

Figure 4: You may wish to expand the facilities of EMAILNLM.NLM, especially on large LANs, by giving it the ability to create new threads.

manual), you're ready to produce an NLM. If you have several C source files, you may want to create a makefile to handle the compile and link steps. For small projects, a batch file (.BAT for DOS or .CMD for OS/2) will do nicely. On the compiler's command line, use

```
-mf (32-bit, flat memory model)
```

and

```
-NETWARE
```

to tell WCC386.EXE what kind of code to produce.

After compiling your NLM and installing the executable file in the SYS:SYSTEM directory, you're ready to test your software by walking over to the file-server console and issuing a LOAD command. Before you start the testing process, however, remember that people on the LAN may be using the file server at that very moment. You don't want to have to use the intercom to announce

that you've found it necessary to reboot the server—especially if workstations on your NetWare LAN happen to control heart/lung machines in an intensive care unit! So, you definitely want to make special plans regarding the testing of your NLM. Either schedule after-hours access to the server or arrange to use a server that no one minds losing a few times each day. A dedicated test server would be better still.

The NetWare 3.11 and 4.0 network operating systems both have a built-in debugger you can use to monitor the behavior of your NLM as it runs. In addition, you can debug your NLM remotely from your workstation, using the Watcom WVIDEO debugger. You'll find details on setting up and using these debugging facilities in the Debugger's User Manual that comes with the SDK.

EXERCISES LEFT FOR THE STUDENT As I indicated at the outset, if you want to put EMAILNLM.NLM to actual use, you will have to do a little programming first. Exactly how much is up to you, but at a minimum you'll need to write workstation software that uses IPX to communicate with the e-mail NLM, sending and receiving the Message C-struct packets I've described.

You can use any kind of workstation and operating system you prefer—Macintosh System 7, DOS, DOS-and-Windows, OS/2, or Unix—as long as the workstation is part of a NetWare LAN. Send packets containing the appropriate Action Codes to the NLM and look for and process the NLM's responses. In this way, you should have no trouble creating a useful e-mail environment that works

EMAILNLM.NLM

Partial Listing

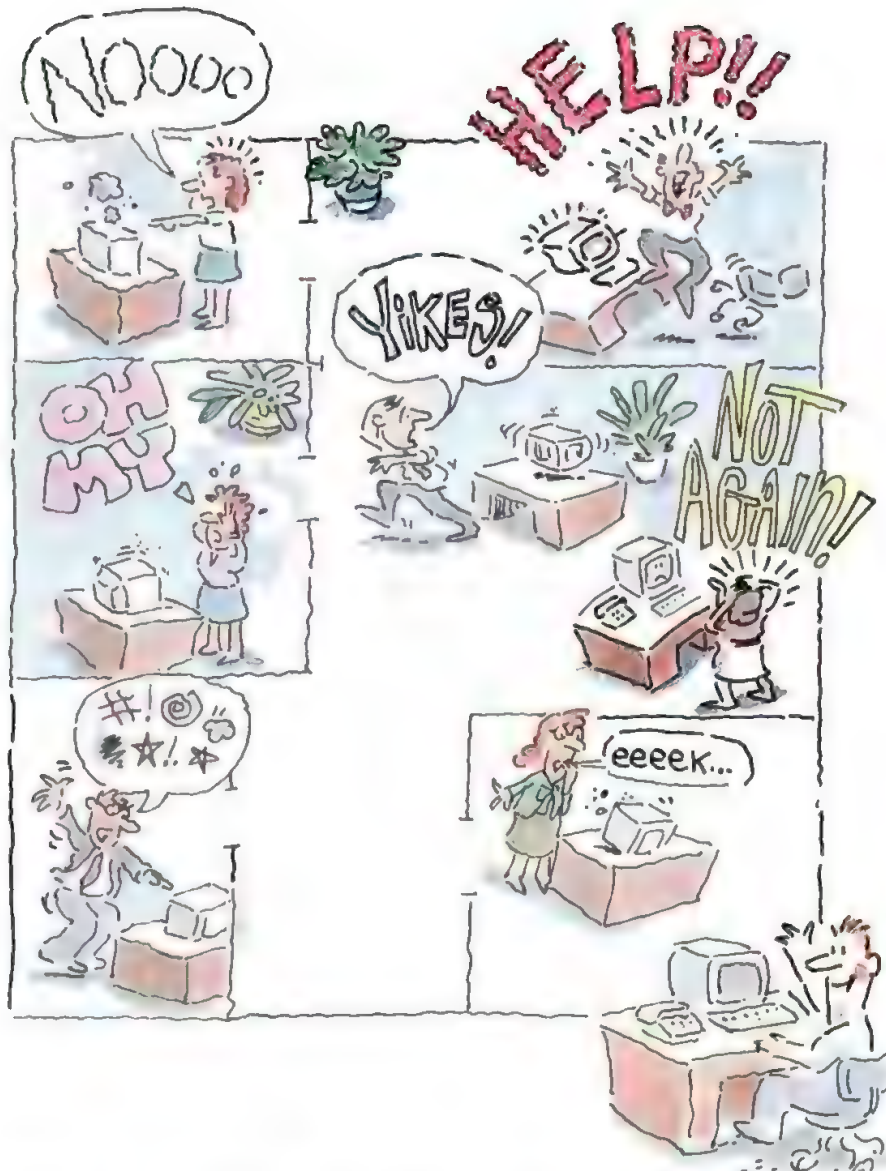
```

Message.MailID = MailSub;
Message.Sequence++;
memcpy(&IpxHeader.destNet, &IpxHeader.sourceNet, 10);
IpxHeader.destSocket = Socket;
IpxHeader.packetType = 4;
EventControlBlock.fragCount = 2L;
EventControlBlock.fragList[0].fragAddress = &IpxHeader;
EventControlBlock.fragList[0].fragSize = sizeof(IpxHeader);
EventControlBlock.fragList[1].fragAddress = &Message;
EventControlBlock.fragList[1].fragSize=Message.Length+10;

IpxSend(Socket, &EventControlBlock);

```

Figure 3: The mail header items shown here allow the workstation to display the in-basket and out-basket items and issue a Read Mail request.



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CIRCLE 039 ON READER SERVICE CARD

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See the Mouse Point.

See the CPU Process.

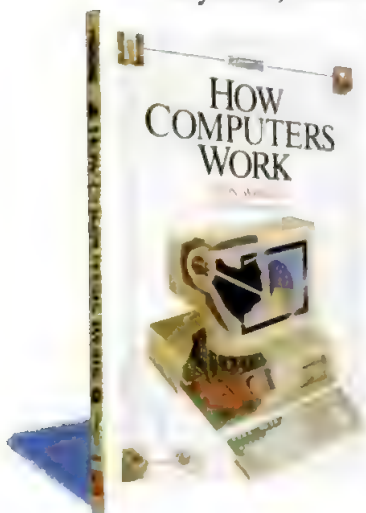
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the way you want and that has the user interface you choose.

You'll think of many customizations, extensions, and enhancements for the e-mail NLM I've described. You might, for instance, want to explore the possibility of making the NLM multithreaded, so it can better handle the large volumes of mail it might encounter on large LANs. Otherwise, the main NLM thread might fall behind trying to keep up with a sudden inrush of mail requests from several workstations. You can use code similar to that shown in Figure 4 to launch new threads. Then, in each thread—the `WorkstationThread()` function, in Figure 4, you handle the mail messages for a particular workstation. When the dialog with the workstation is finished, the thread function can simply terminate after closing files and IPX sockets.

Again, you might want to extend the NLM to handle and deliver attached binary files. Depending on how you want to design your mail attachment mechanism, you might insert a new field into the Message packet to identify a series of packets as containing binary file material. If your LAN is part of a larger network (a Wide Area Network, or WAN), you might want to enhance the NLM to operate on each NetWare file server and automatically exchange mail that belongs in a different post office. You might even customize the NLM to handle the mail forwarding, sending to groups of people based on personal address lists, and distinguishing between regular recipients and carbon copy recipients.

SUMMARY Developing NLMs has the reputation of being an alien, difficult kind of programming. That reputation is not entirely deserved. If you have spare CPU cycles in your NetWare 3.11 server, or if you run workstation software that frequently plows through large shared files looking for answers, you can use an NLM to make your LAN more productive. But just make sure that you first test your NLM software well. □

BARRY NANCE IS THE AUTHOR OF *USING OS/2 2.1*, *NETWORK PROGRAMMING IN C*, AND *INTRODUCTION TO NETWORKING*. HE IS THE EXCHANGE EDITOR FOR THE IBM EXCHANGE ON BIX, WHERE YOU CAN REACH HIM AS BARRYN.

AEDIT: An Editor for All Seasons

BY DOUGLAS BOLING

Tom Kihlken's Tiny EEditor (TED, in Utilities, *PC Magazine*, November 15, 1988) has long been the classic utility for editing small text files and for keeping on your emergency boot-up disk. Today, however, a truly portable editor must be able to run under OS/2 and Windows NT as well as under DOS or in a Windows DOS box. Thanks to its design as a Family Application, AEDIT.EXE provides just such multiplatform functionality.

AEDIT is a full-screen, menu-driven text editor for basic file, editing, and search-and-replace operations. It also provides a few advanced features, such as Undo Last Edit, Set Tabs, and GOTO Line and Column. Unlike TED, whose maximum file size was limited to 64K, AEDIT can work on any text file that will fit within system memory. This file size limitation is about 400K in a typical DOS setup; the virtual memory management techniques of OS/2 and NT systems make multiple megabytes of RAM effectively available.

AEDIT is not designed to replace your word processor or to match the functions and configurability of commercial programmers' editors, however. It has no formatting and printing capabilities, for example, and it treats all characters up to a hard carriage return as part of a single line (that is, it has no word wrap).

Under DOS or in a Windows DOS box, AEDIT executes as a standard DOS program. In an OS/2 or NT system it runs as a standard character-mode application that can even edit files with long filenames on High Performance File System (HPFS) drives. AEDIT accomplishes this feat by using only functions that are part of FAPI (Family Application Pro-

gram Interface). The FAPI standard was introduced in OS/2 1.x and allows programmers to create OS/2 programs that can also run under DOS. I'll discuss these functions later in the article.

You can get a copy of the executable AEDIT.EXE and of its C-language source code from PC MagNet by following the instructions in the sidebar "How to Get PC Magazine's Utilities."

Compiling AEDIT can be somewhat of a chore, however, for in order to com-

the beginning of the file.) Note that each of these parameters must be separated by a space.

Typically, you would begin to edit an existing file simply by entering

```
AEDIT C:\AUTOEXEC.BAT
```

AEDIT will display the file on the screen, as shown in Figure 1. The top screen line is used for the menu, while the bottom line reports status information, including the filename, cursor line and column position, the state of the insert/overstrike toggle (the default is I, for *insert*; O signifies *overstrike*) and whether the search for a string is to be case-sensitive or not. (The lowercase s default signifies that string searches do not require matching capitalization; an uppercase S means that an exact match is required.) The status line also indicates whether NumLock (#) and CapsLock (Up Arrow) are active.

The menu layout and key-assignment standards follow the standard CUA (Common User Access) guidelines

*Equally at home under
DOS, a Windows DOS
Box, OS/2, or Windows
NT, AEDIT answers the
need for a small, portable,
line-oriented text editor.*

pile an OS/2 Family Application, you will need either the OS/2 1.x SDK from IBM or Version 5.1 or 6.0 of Microsoft C. You'll also need the OS/2 include files and the BIND application that turns a conforming OS/2 1.x character-mode application into a Family Application. For help finding these products, you may need to contact your compiler vendor.

USING AEDIT The full syntax for the AEDIT command is

```
AEDIT [/Tn] [/Ln] [/Cn]  
[ [path] filename]
```

The optional /T, /L, and /C switch parameters set the Tab spacing (the default is 8) and allow you to begin a file or bring up a specified *filename* at a particular line and column. (The default for both is 1,

Top 10 DOS Utilities

Rank	Utility
1	DIRMATCH - Compares directories
2	BAT2EXEC - Compiles batch files
3	DEFRAGR - Defragments disks
4	CHKFRAG - Checks fragmentation
5	PCSPool - Print spooler
6	STRINGS - Batch file versatility
7	PCUNZP - Unzips files
8	PCREM2 - Remotely operates computer
9	GDX - Changes directories
10	BOOT2C - Forces hard disk boot

This list is based on the total number of downloads each utility has had on PC MagNet over the past 12 months. To download these files, type GO ZNT:TIPS. For more information, see the sidebar "How to get PC Magazine's Utilities."

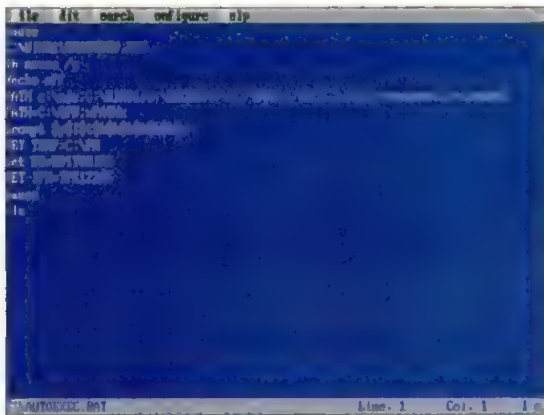


Figure 1: The opening screen of AEDIT when an AUTOEXEC.BAT file has been called up.

shared by OS/2 and Windows. The top-level menu includes File, Edit, Search, Configure, and Help submenus, and you activate the menu items by holding down the Alt key and pressing the highlighted letter for the item you want.

A number of AEDIT's functions also have their own shortcut keys, many of which follow the IBM CUA guidelines. An exception is that the key assignments for the Edit functions—Cut, Copy, and Paste—correspond to those of the Macintosh and Windows 3.1 Clipboards. Figure 2 contains a complete list of AEDIT key assignments.

The File submenu includes the usual New, Open, Save, Save As, and Exit items. The New menu item opens an empty, unnamed file; Open prompts you for an existing filename. The Save and Save As functions allow you to save your work to the same file or to a freshly created one. If you make any editing changes to a file, AEDIT will prompt you to save before exiting.

The Edit-menu Cut, Copy, and Paste functions use an internal buffer into which highlighted text is inserted. While similar in function to the Clipboard of Windows or OS/2, the buffer must remain independent of those clipboards because AEDIT is a character-mode application. Text to be cut, copied, or deleted is marked by holding down the Shift key while moving the cursor with the usual navigation keys. Pressing the Delete key wipes out the currently marked area or (if no text is highlighted) the character at the cursor. The Ctrl-E shortcut key deletes to the end of the line, whether the

text is marked or not.

The Paste function inserts the text from the buffer into the file at the current cursor location. Because the text in the buffer remains even after a Paste command, the same data can be copied into the document any number of times. The Undo function of the Edit command simply reverses the last Cut, Copy, Paste, or Delete command; it does not undo any other operations.

The Search menu includes the Find, Repeat, Change, and GOTO functions. Both the Find (search) and Change (search-and-replace) items prompt for the necessary strings. Starting from the current cursor position, Find locates the first instance of the search string. The search can be continued through the remainder of the file by selecting the Repeat menu item or (more easily) by pressing the Ctrl-R shortcut key. Change automatically continues through the file, giving you a Yes, No, or Quit choice at each successive match.

Both Find and Change are affected by the Respect Case flag. By default, searches are case-insensitive: Capitalization is ignored. If the Respect Case flag is set, however, either through the Configure menu or by using the Ctrl-A shortcut key, only exact string matches will be recognized. The GOTO function asks for a line number, then moves the cursor to that line.

The Configure menu allows you to set tabs and change the state of the Re-

spect Case flag. Like the initial /Tn switch parameter, the Configuration menu's Tab function accepts only a single value, which is then used to set tab stops throughout the document.

Finally, the Help menu has two items: Keys and About. The Keys menu item presents the user with a help screen showing all the key assignments, and choosing About displays the customary copyright information.

INSIDE AEDIT As I discussed in connection with my FINDEXEC utility (Utilities, *PC Magazine*, August 1993), FAPI represents a halfway point between functionality of the DOS and OS/2 APIs. For DOS applications, FAPI provides a complete set of functions DOS programmers usually only dream about. OS/2 programmers, on the other hand, may find the FAPI spec somewhat confining. For-

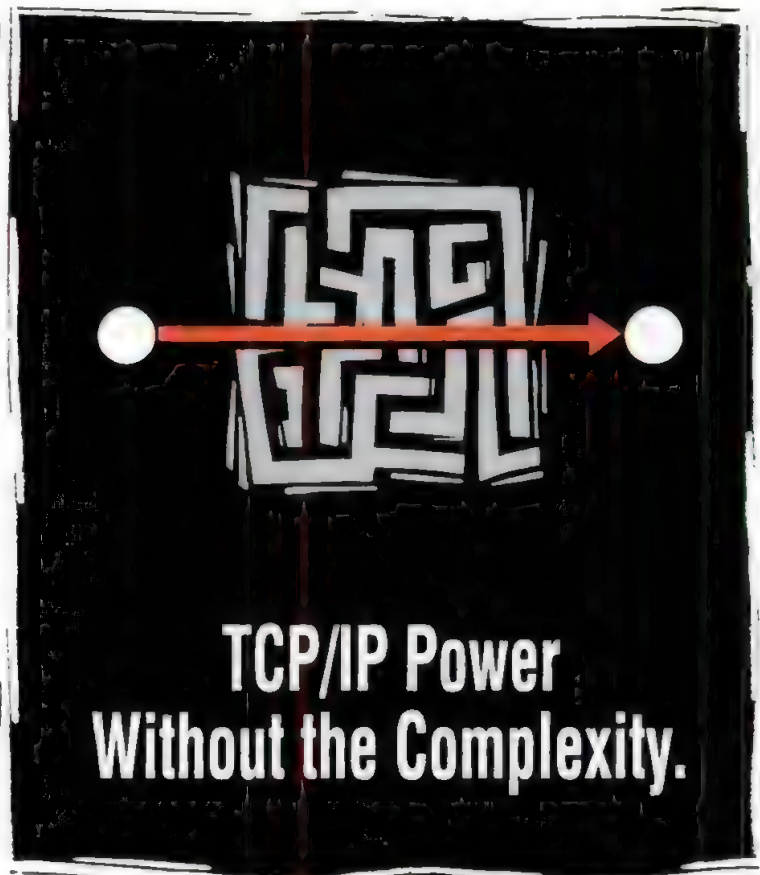
AEDIT Key Assignments

Key	Function
Down	Move cursor down one line
Up	Move cursor up one line
Left	Move cursor left one character
Right	Move cursor right one character
PgDn	Page down one screen
PgUp	Page up one screen
Home	Move cursor to start of line
End	Move cursor to end of line
Enter	If insert on, split line; else move to start of next line
Ctrl-PgUp	Move cursor to screen top
Ctrl-PgDn	Move cursor to screen bottom
Ctrl-Home	Move cursor to start of file
Ctrl-End	Move cursor to end of file
Ctrl-Right	Move cursor to start of next word
Ctrl-Left	Move cursor to start of previous word
Insert	Toggle Insert/Overstrike mode
Del	Delete character or marked area
Backspace	Delete previous character
Ctrl-A	Toggle Respect Case flag
Ctrl-C	Copy marked area to cut buffer
Ctrl-E	Delete to end of line
Ctrl-G	GOTO line number
Ctrl-S	Search for string
Ctrl-R	Repeat last search
Ctrl-T	Search and replace
Ctrl-V	Paste
Ctrl-X	Cut marked area to buffer
Ctrl-Z	Undo last Cut, Copy, Paste or Delete area
Alt-F4	Exit
Alt-X	Exit

Figure 2: The key assignments for AEDIT generally follow the Common User Access guidelines.

PathWay Access

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 - ▲ TN3270, 3179G
 - ▲ Tektronix 4105/4010
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CIRCLE 103 ON READER SERVICE CARD

tunately, FAPI provides more than enough functionality for the job of writing a full-screen text editor.

When AEDIT starts, it determines the screen dimensions and saves the current state of the screen to a buffer. The keyboard state is then set to binary mode so that it won't interpret a special character such as Ctrl-C as a request to break out of the program.

Next, the command line is parsed to determine the name of the file to edit and to check whether any of the optional switches have been entered. If a filename was on the command line, the file is opened and its file size is saved; other-

wise, an empty buffer is allocated for a new file.

AEDIT then draws the first lines of the file on the screen and enters a keyboard scanning loop. In the keyboard loop, AEDIT first draws the menu on the screen. As determined by the pCurrMenu pointer, the menu drawn can be either the main or a submenu. If the Alt key is pressed, or if the menu is not the main menu, the menu is drawn using the jump characters of each menu item highlighted. After drawing the menu, AEDIT uses its GetKey routine to check whether a key has been pressed.

If no key has been pressed, the Free-

BuffSpace routine is called. I'll discuss the purpose of this routine below, but it should be noted that AEDIT spends much of its time in FreeBuffSpace. An editor spends most of its time waiting for the user to enter a key. Indeed, in relation to the computer's speed there's a long time between keystrokes even when the user is typing. As long as FreeBuffSpace does its job quickly and returns, the user will never know that AEDIT is busy with chores other than waiting breathlessly for the next key.

When a key is pressed, the ProcessKey routine is called. ProcessKey calls the appropriate function for the key and returns

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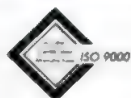
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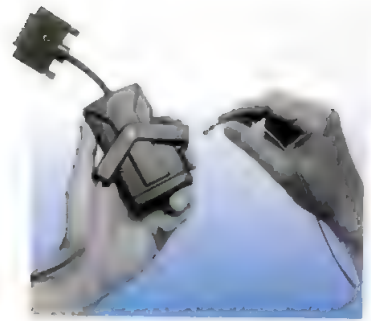
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CIRCLE 397 ON READER SERVICE CARD

a Boolean value that is assigned to the variable `fContinue`. After `ProcessKey` returns, a flag is checked to determine whether a highlighted area on the screen should continue to remain so marked. If Shift is being held down and the key is a cursor-movement key, the screen is redrawn to continue highlighting. If not, and if the screen has been marked, the screen is redrawn without the highlight.

Finally, the status line is redrawn and `fContinue` is checked to see whether the keyboard scanning loop should exit. If `fContinue` is TRUE, the whole process starts over again. If `fContinue` is FALSE, AEDIT exits the keyboard loop, closes the file being edited, restores the screen to the state it was in when AEDIT was started, and terminates.

EDIT CODE Having set the background by discussing the basics of the main routine, I can get to the fun part of AEDIT: the file edit code.

To simplify memory management as much as possible, AEDIT makes extensive use of huge pointers. Huge pointers are far pointers that can be incremented beyond the normal 64K limit of 16-bit DOS and OS/2 1.x segments. Huge pointers are handy, since all the work needed to maintain the proper segment for the pointer is hidden. Huge memory blocks can be allocated by FAPI programs by using the `DosAllocHuge` call.

When called in OS/2, `DosAllocHuge` allocates enough consecutive 64K segments to reserve the requested amount of memory. When huge pointers are then used in a huge memory block, the compiler adds code to interact with the operating system to keep the proper selector value in the pointer. Under DOS, of course, programs can simply add numbers to segment values, but with huge pointers, this too is handled by the extra code added by the compiler.

When AEDIT loads a file, it allocates two huge blocks of memory, one for an array of huge pointers, called the *line pointer buffer*, and the other for the file data itself. The size of the two blocks depends on the size of the file. When AEDIT is running under DOS, the line pointer buffer is set to 64K, which is large enough to hold 16,384 pointers. When running under OS/2, the buffer is originally allocated the same 64K, but it can

QUICK REFERENCE CARD

AEDIT Command



Douglas Boling

November 23, 1993 (Utilities)

Purpose:

A small, menu-driven, line-oriented text editor that can be run from DOS, OS/2, Windows NT, or a Windows DOS box. In addition to providing basic file, editing, and search-and-replace operations, AEDIT includes Undo Last Edit, Set Tabs, and GOTO Line and Column features, and it can handle all file sizes that will fit within the system memory.

Format:

AEDIT [/Tn] [/Ln] [/Cn] [[path] filename]

Remarks:

The optional switch parameters set the tab spacing (/T) and the line (/L) and column (/C) at which the cursor is initially placed. The default values of *n* are 8, 1, and 1, respectively, which provide tab stops every eight characters and put the cursor at the start of the file.

The top-level menu contains File, Edit, Search, Configure, and Help menu items, each of which has submenu selections. Under File are New, Open, Save, Save As, and Exit; under Edit are Cut, Copy, Paste, and Undo. Text cut or copied to the AEDIT buffer can be pasted repeatedly. The Undo function affects only the last Editing operation. Search items comprise Find, Repeat, Change, and GOTO (line), and Help accesses Help and the usual About box.

To select a menu item, hold down the Alt key while pressing the highlighted letter. Text can be marked for cut, copy, or delete operations by holding down the Shift key and moving the cursor. Many of the functions have shortcut keys, which are listed in the Help selection.

Both Find and Change are affected by the Respect Case flag, which can be changed at the Configuration menu. By default, upper- and lowercase are ignored in determining a string match, but this can be toggled to the opposite state. The Tab setting can also be changed from the Configuration menu.

A status bar at the bottom of the screen indicates the filename, cursor line and column position, insert (I) or overstrike (O) mode, case-sensitive (S) or not (s), and whether CapsLock (Up Arrow) or NumLock (#) is active. Prompts for strings to enter and reminders to save before exiting also appear in the status bar.

FreeBuffSpace

Complete Listing

```

//-----
// FreeBuffSpace - Moves free edit buffer space to the end of the
// buffer.
//-----
HPSZ FreeBuffSpace (PEDITSTATE pe, HPSZ lpszStart) {
    HPSZ lpszNext;
    LONG i;
    static LONG lLastLine;
    BOOL fFound = FALSE;
    if (pe->lLines == 0)
        return 0;
    if (lpszStart == 0) {
        lpszStart = (HPSZ) MAKEP (pe->seleBuff, 2);
        lLastLine = 0;
    }
    //
    //Find next free space in buffer. If at end, return ptr to
    // start of buffer for next pass.
    //
    while ((*lpszStart != '\0') && (lpszStart < pe->lpEEnd))
        lpszStart++;

    if (lpszStart == pe->lpEEnd)
        return (HPSZ) MAKEP (pe->seleBuff, 2);
    //
    //Point to next char, scan to find next string. If at end,
    // adjust end ptr to last occupied space. If no gap, return
    // with updated starting pointer.
    //
    lpszStart++;
    lpszNext = lpszStart;
    while ((*lpszNext == '\0') && (lpszNext < pe->lpEEnd)) {
        lpszNext++;
    }
    if (lpszNext >= pe->lpEEnd) { //If at end, move end
        pe->lpEEnd = lpszStart; //ptr to last valid char.
        return (HPSZ) MAKEP (pe->seleBuff, 2);
    }
    if (lpszNext == lpszStart) //If no gap, return.
        return lpszStart;
    //
    // Find line in line ptr buff.
    //
    for (i = lLastLine; i < pe->lLines; i++)
        if (GetFileLine (pe, i) == lpszNext) {
            fFound = TRUE;
            break;
        }
    if (!fFound)
        for (i = 0; i < pe->lLines; i++)
            if (GetFileLine (pe, i) == lpszNext) {
                fFound = TRUE;
                break;
            }
    if (!fFound) {
        if (pe->lpCutBuff == lpszNext)
            pe->lpCutBuff = lpszStart;
        else if (pe->lpUndoBuff == lpszNext)
            pe->lpUndoBuff = lpszStart;
    } else {
        SetLinePtr (pe, i, lpszStart);
        lLastLine = i;
    }
    //
    //Move line into gap in buffer.
    //
    while (*lpszNext != '\0') {
        *lpszStart++ = *lpszNext;
        *lpszNext++ = '\0';
    }
    *lpszStart = '\0';
    return lpszStart;
}

```



Figure 3: The FreeBuffSpace routine compacts the lines from the beginning of the data buffer, thus freeing space at the end of the buffer.

be expanded to 256K by reallocating the buffer.

The line pointer buffer contains an array of far pointers. Each pointer points to a line in the file data buffer. Since there must be a pointer in the line pointer buffer for each line in the file, a file edited under DOS is limited to 16,384 lines. Under OS/2, this limit is increased to 65,536 lines.

The data buffer is set to be a few kilobytes larger than the file size. Since the buffers are huge, they can exceed the normal 64K limit usually associated with DOS and OS/2 1x programs. If necessary, the buffers can be resized to handle more data; in the case of the line pointer array buffer, this happens when the file has more than 16,384 lines.

If the buffers are allocated successfully, AEDIT reads the file into the data buffer, starting at offset 2 in the buffer. Offsets 0 and 1 in the data buffer are reserved and set to 0; I'll discuss the use of these two memory locations presently.

AEDIT sets the first pointer in the line pointer array to point to the first byte of the file in the data buffer. The data is then scanned to find the first carriage

return character (0D hex), which indicates the end of the first line. When found, the carriage return is replaced by a 0 byte. If, as usually is the case, a line-feed character (0A hex) follows the carriage return, it too is set to 0. The character following the carriage return (or line-feed, if present) is the start of the second line. The second pointer in the pointer array is set to point to this starting character. The process is repeated until all lines in the file have been located and their line pointers set. Once this process is complete, AEDIT has an array of pointers, each pointing to a line of text in the file data buffer.

There is one exception to this process of locating lines. If AEDIT finds an empty line—that is, one with only a carriage return—the pointer for that line is set to point to the first of the two reserved bytes in the data buffer. This is necessary because otherwise the pointer for this line would point to a 0 byte, and as I'll explain in a moment, this must not be allowed to happen.

After all lines have been located, the remainder of the pointers in the line pointer array are set to point to the sec-

ond of the two reserved bytes in the data buffer. The trick to be noted here is that if AEDIT sees that a line pointer points to this specific byte, then it knows the line pointer is beyond the last line in the file.

Once the file has been loaded and the pointer array initialized, the position of each line in the data buffer is independent of its position in the file. If a particular line is moved somewhere else in the data buffer, the editor simply updates the pointer to that line. It is the position in the array of the *pointer* to a line that determines the line's location in the file. This position independence allows the remainder of the editor code to rearrange lines freely in the data buffer as necessary. As long as the pointer to that line is updated when the line is moved, the line will never get lost.

Displaying the file is fairly simple. As a line needs to be sent to the screen, the GetScreenLine routine is called, which returns a pointer to that particular line. The GetScreenLine routine itself is trivial, as it has only to correct for the position of the top line of the screen in reference to the file. For example, to return a pointer to the third line on the screen

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if the screen's top line is 200, GetScreenLine adds 200 to 3 and returns pointer number 203 from the line pointer array. Where the string actually is in the data buffer is irrelevant.

Overwriting a character on a line is just as easy. When the user presses a key, AEDIT calls GetScreenLine for the current line; that is, the line on which the cursor sits. Another routine, GetScreenChar, is then called to return a pointer to the specific character on the line. Once the pointer to the specific character is returned, that character is simply replaced by the character entered by the user. Although it might seem that all the GetScreenChar routine would have to do would be to add the column position to the line pointer, things are not *that* easy. Tab characters take up only one character in the character string, for example, but they are normally displayed as multiple spaces on the screen. This means there is no automatic 1:1 correspondence between the positions of characters on the screen and characters in a line.

Inserting characters is more of a challenge. The problem, of course, is that AEDIT must make room in the line for an extra character. It can not simply move the characters to the right of the insert point over one character because there probably is another line stored in the data buffer just beyond the current line, and that would also have to be moved. To avoid all of this, AEDIT simply moves the current line to the end of the data buffer where no lines follow it. When the line is moved, the pointer in the line pointer array to that line is also updated, and the old position occupied by the line is filled with zeros. Once the current line is at the end of the data buffer, the characters to the right of the insert point are then moved over by one to make room for the character to be inserted.

With all this moving of lines, however, it would seem that the edit buffer would uncontrollably grow to use all of memory. To avoid this, a "garbage collection" routine is used to collect all the unused space (garbage) in the buffer. The routine that accomplishes this garbage collection is the FreeBuffSpace routine I mentioned earlier, which is listed in Figure 3.

FreeBuffSpace works by filling empty

space in the data buffer with the line that immediately follows the empty space. That is to say, if a gap appears in the data buffer, FreeBuffSpace finds the next line in the buffer, then slides that line back so that it fills the vacancy. Whenever any line is moved in the data buffer, the old characters are zeroed out. Any zeros in the buffer (beyond the single zero that terminates each line) denotes empty space in the buffer that can be filled by FreeBuffSpace. As the lines are moved in the buffer, the pointers to the lines are found and updated.

This allows the lines to be rearranged without affecting the other parts of AEDIT. After FreeBuffSpace moves one line, it returns with a pointer to the newly moved line. This allows the routine to pick up where it left off in the buffer when it is called again. When FreeBuffSpace completely scans the entire data buffer, it returns a pointer to the start of the buffer. The next time it is called, FreeBuffSpace will start again at the top of the buffer.

You may notice in Figure 3 that FreeBuffSpace does not contain a loop to process the lines of the file. This is because FreeBuffSpace must operate quickly and return so that the keyboard loop can check for another key. However, since it is likely that no key has been pressed, AEDIT will soon call FreeBuffSpace again so that it can continue its chore.

When the user saves the file, the AEDIT save routine sequentially gets a pointer to each line, writes the line to the file, and appends a carriage return and line-feed. The file is then closed.

AEDIT demonstrates one method of writing a full-screen text editor. For those who are interested in the AEDIT code but who do not have the tools to compile a FAPI application, I have isolated the operating system calls to a handful of routines at the end of the source code. This should allow interested programmers to substitute DOS function calls for the OS/2 calls. And even if you are not interested in delving into the code, AEDIT is a small but handy program to add to your tool chest of utilities. □

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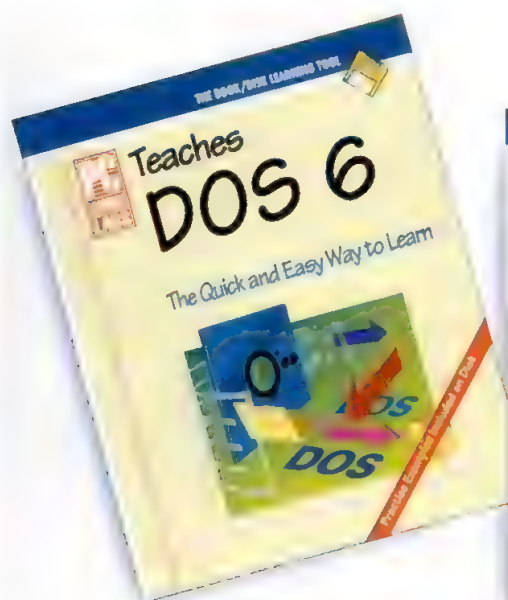
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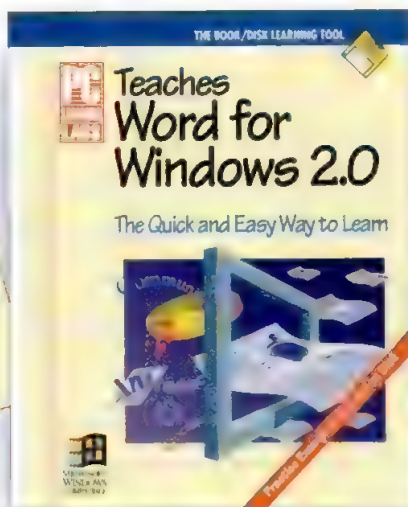
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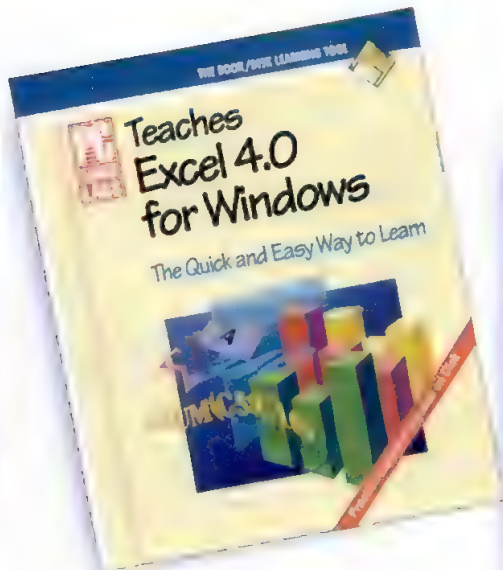
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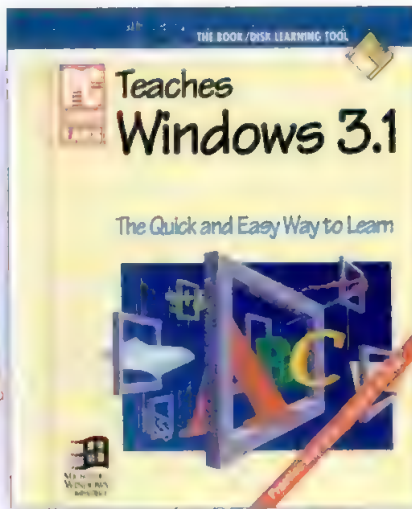
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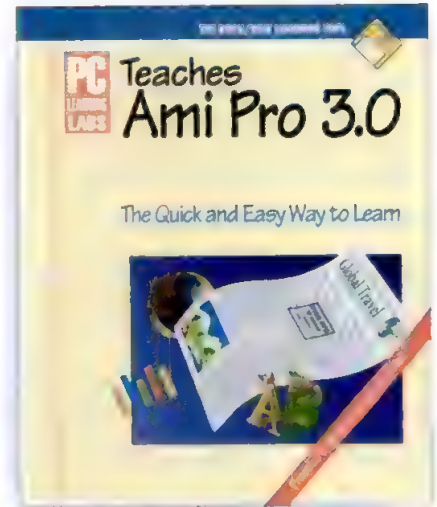
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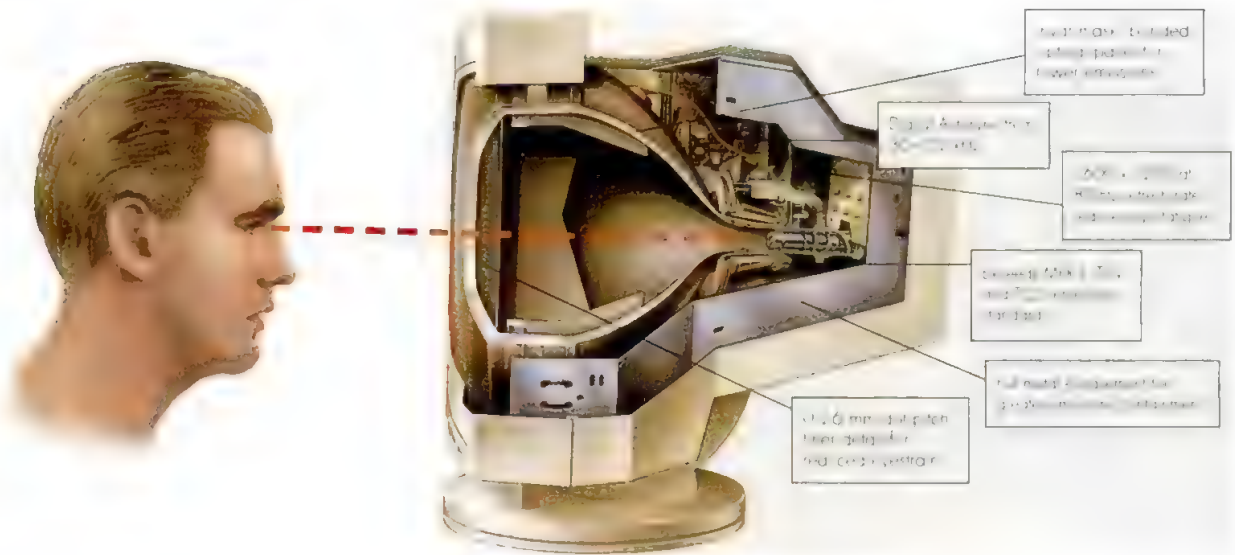
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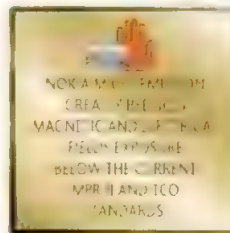
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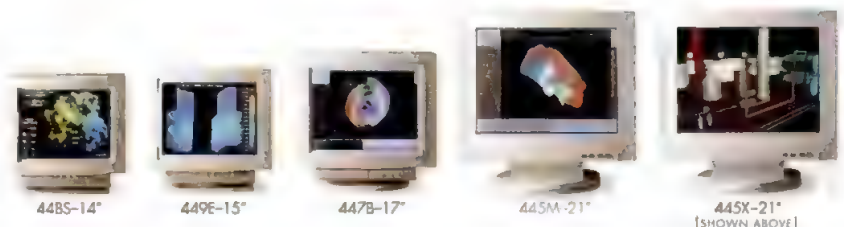


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Viewing a Unicode TrueType Font Under Windows NT

BY CHARLES PETZOLD

When the documentation accompanying one of the early betas of Windows NT indicated that the release included a TrueType font containing Unicode extensions (albeit a very small subset), naturally I wanted to take a look. I had a program I wrote awhile ago called CHARSET that displayed the 256 characters of a font in the customary 16-by-16 grid format. The mechanics of adapting this program for Unicode proved to be fairly simple, but only after I figured out how to use Unicode within a Windows NT program. The result is UNICHAR, a program we'll look at in this column. I'll also discuss how Windows NT supports Unicode while continuing to be consistent with old ASCII programs.

A BRIEF REVIEW Unicode is a fairly recent standard (first published just a couple of years ago) for representing all the written languages of the world using 16-bit character codes. Whereas an 8-bit character encoding can represent only 256 characters, 16-bit codes allow 65,536. To my knowledge, Windows NT is the first operating system to support Unicode internally from the ground up. (Unicode support is slated for a future version of OS/2.) In the last issue, I discussed how support for 16-bit characters (that is, "wide characters") is part of the ANSI C standard. Basically, if you want to use wide characters, you don't use the familiar char data type. Char remains an 8-bit value. Instead, you use wchar_t, defined in the WCHAR.H header file as

```
typedef unsigned short wchar_t;
```

To indicate to the C compiler that a literal character string is to be stored with

16-bit values, you preface the first quotation mark with an L, as illustrated in the following definition of a character array:

```
wchar_t a[] = L"Hello, World!" ;
```

The WCHAR.H header file also defines alternative C runtime library functions that support wide character strings—for example, wcslen (the wide-character version of strlen) and wprintf (the wide-

eters—for example, _tprintf. Depending on the definition of a _UNICODE identifier, _tprintf is defined to be either wprintf or printf. (The function name is prefaced by an underscore because it is not part of the ANSI C standard.)

Finally, TCHAR.H provides three macros named _T, _T_, and _TEXT that solve the problem of appending an L to the beginning of a character string. These three functions work identically. The single parameter to the macro is a character string in quotation marks. If the _UNICODE identifier is defined, then the macro appends an L; otherwise, the macro does nothing to the string.

WINDOWS NT SUPPORT As I mentioned, Windows NT supports programs written for ASCII, for Unicode, or for a mix of ASCII and Unicode. At first, this sounds baffling. For example, when a Windows NT program calls the TextOut function—one of the many, many functions in NT that take a string parameter—how does the system know whether the string is comprised of 8-bit characters or wide characters? All the function knows is that it has a string of bytes.

The answer is simple: In Windows NT, there is really no function named Text Out! It has been replaced with two functions named TextOutA (the ASCII version) and TextOutW (the wide-character version). Every function in Windows NT that requires a character string parameter has two entry points in the system. Does this mean you'll have to convert your programs to use one name or the other? Fortunately, no. As in the TCHAR header file, the various Windows NT header files perform the necessary tricks.

In the Win32 Software Development Kit, the big WINDOWS.H header file that we've been dealing with under the DOS-based version of Windows has been replaced with smaller header files dedi-

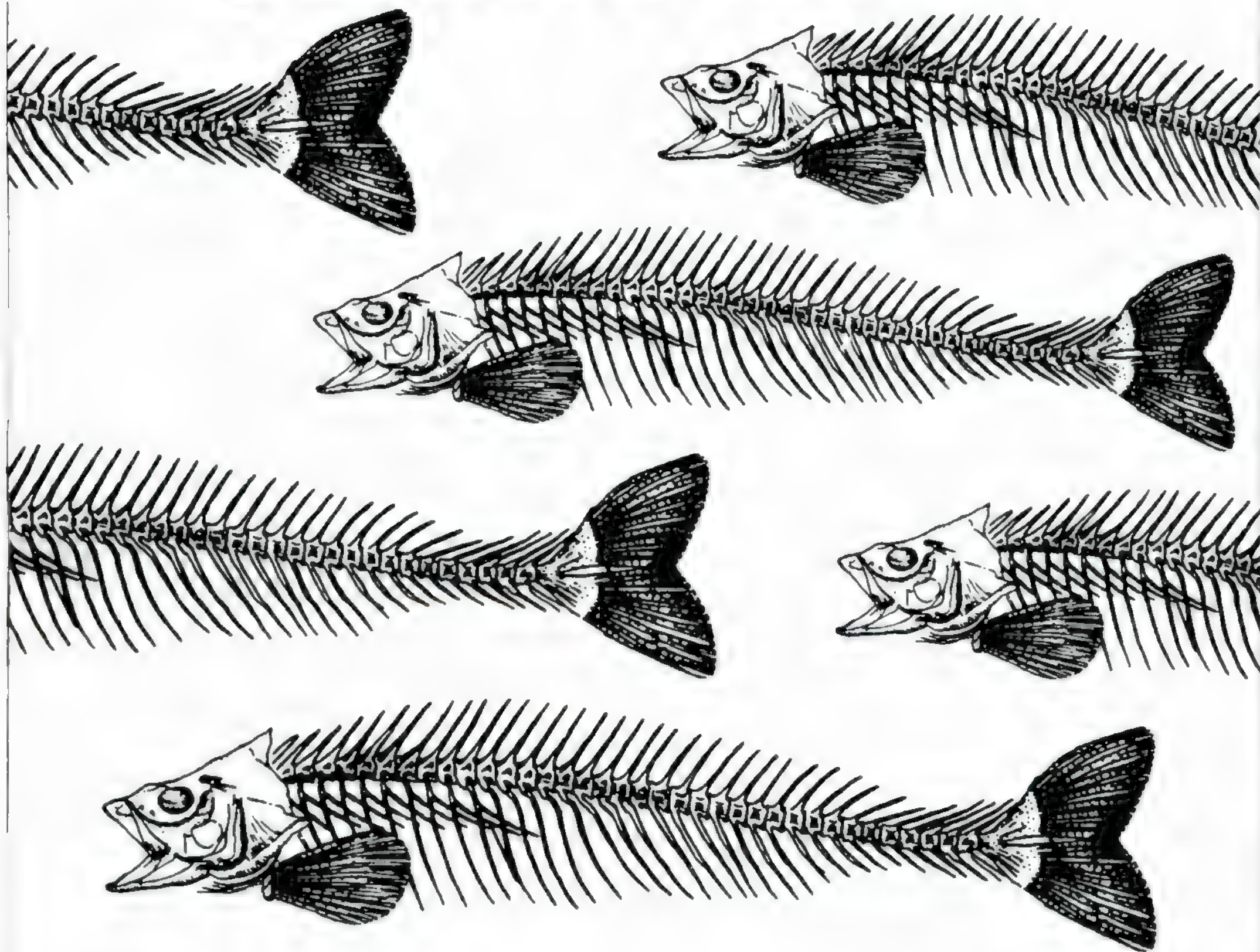
*In this column
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at how Windows NT
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character version of printf). Thus, as far as C is concerned, you can write a program that uses a mix of 8-bit characters (ASCII) and wide characters (Unicode).

In the C compiler shipped with the Win32 Software Development Kit, Microsoft also provided a non-ANSI header file called TCHAR.H that allows a programmer to create a single source code file that can be compiled for either ASCII or Unicode support. To define characters and character strings, you have to use a data type called TCHAR. Depending on the definition of an identifier named _UNICODE, TCHAR is defined to be either wchar_t or char.

TCHAR.H also defines a set of alternative names for the normal runtime library functions that require string param-

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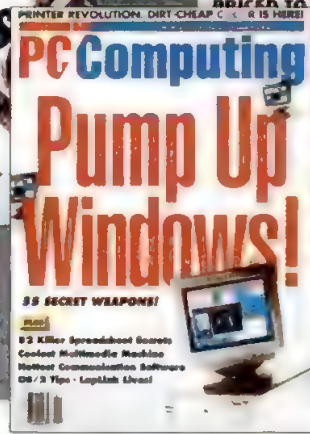
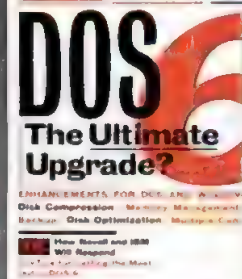
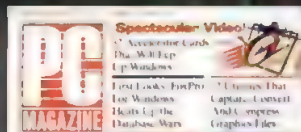
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UNICHAR.MAK

Complete Listing

```

#-----
# UNICHAR.MAK make file
#-----

!include <ntwin32.mak>

unichar.exe : unichar.obj unichar.rbj
    $(link) $(guiflags) -out:unichar.exe unichar.obj unichar.rbj $(guilibs)

unichar.obj : unichar.c unichar.h
    $(cc) $(cflags) $(cvars) unichar.c

unichar.res : unichar.rc unichar.h
    $(rc) $(rcvars) -r unichar.rc

unichar.rbj : unichar.res
    cvtres -$(CPU) unichar.res -o unichar.rbj

```



Figure 1: This is the make file that facilitates compiling and linking the UNICHAR program.

cated to various components of the NT system. You still include WINDOWS.H in your programs, and this file includes the others.

The WINNT.H header file handles the basic Unicode support. The header file includes CTYPE.H, which also defines the wchar_t data type. The header file then defines a new data type called WCHAR:

```
typedef wchar_t WCHAR ;
```

Data types such as PWCHAR (a pointer to a wide character string) and LPCWSTR (a const pointer to a wide character string) are also defined. These complement the normal PCHAR and LPCSTR data types used with 8-bit character strings.

The WINNT.H header file also defines the TCHAR and PTCHAR data types, which are the generic versions. If the identifier UNICODE (without the underscore) is defined, these data types are defined like so:

```
typedef WCHAR TCHAR, *PTCHAR;
```

If not, they're defined like this:

```
typedef char TCHAR, *PTCHAR;
```

Several other relatives of the character code data types are also defined in this way. Both the WINNT.H and TCHAR.H header files are protected against redefining the TCHAR data type if it's already been defined by one or the other

of these header files. If you're using both header files, you should include WINDOWS.H first to get the definition of PTCHAR.

The WINNT.H header file also defines a macro that appends the L to the first quotation mark of a character string. If the UNICODE identifier is defined, then a macro called __TEXT is defined as follows:

```
#define __TEXT(quote) L##quote
```

The ## macro operator is called the "token paste" that sticks the L onto the beginning of the character string. If the identifier UNICODE is not defined, then the __TEXT macro is defined like so:

```
#define __TEXT(quote) quote
```

Regardless, the TEXT macro is defined like so:

```
#define TEXT(quote) __TEXT(quote)
```

This is very similar to the way the __TEXT macro is defined in TCHAR.H, except that you need not bother with the underscore.

In the WINDOWS.H header file included in the Windows 3.1 Software Development Kit, the TextOut function is defined as:

```
BOOL WINAPI TextOut (HDC, int,
    int, LPCSTR, int) ;
```

The first parameter of this function is a

handle to a device context, the second two parameters indicate x and y coordinates where the text is to begin, the fourth parameter is a pointer to a character string, and the last parameter indicates the number of characters in the string to be displayed.

In the Windows NT development kit, the TextOutA and TextOutW function calls are defined in WINGDI.H, the header file that defines the Graphics Device Interface functions:

```
BOOL WINAPI TextOutA (HDC, int,
    int, LPCSTR, int) ;
```

```
BOOL WINAPI TextOutW (HDC, int,
    int, LPCWSTR, int) ;
```

Note the difference in the fourth parameter. You can use these functions explicitly in your Windows NT programs if you want to mix the usage of ASCII and Unicode.

To convert your existing programs more easily to pure Unicode, you can define the UNICODE identifier before including WINDOWS.H:

```
#define UNICODE
#include <windows.h>
```

The WINGDI.H header file contains the following lines:

UNICHAR.H

Complete Listing

```

/*-----
    UNICHAR.H header file
    -----*/

#define IDM_FONT    1

```

Figure 2: UNICHAR.H defines an identifier used in both UNICHAR.C and UNICHAR.RC.

UNICHAR.RC

Complete Listing

```

/*-----
    UNICHAR.RC resource script
    -----*/

#include "unichar.h"

UniChar MENU
(
    MENUITEM "&Font!",    IDM_FONT
)

```

Figure 3: UNICHAR.RC is the resource script that defines the program's menu.

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UNICHAR.C

Complete Listing

```

/*-----
UNICHAR.C -- Unicode Character Set
(c) Charles Petzold, 1993
-----*/

#include <windows.h>
#include <commdlg.h>
#include <string.h>
#include "unichar.h"

long APIENTRY WndProc (HWND, UINT, UINT, LONG) ;

int PASCAL WinMain (HANDLE hInstance, HANDLE hPrevInstance,
                    LPSTR lpzCmdLine, int nCmdShow)
{
    static char szAppName[] = "UniChar" ;
    HWND      hwnd ;
    MSG       msg ;
    WNDCLASS  wndclass ;

    if (!hPrevInstance)
    {
        wndclass.style      = CS_HREDRAW | CS_VREDRAW ;
        wndclass.lpfnWndProc = WndProc ;
        wndclass.cbClsExtra = 0 ;
        wndclass.cbWndExtra = 0 ;
        wndclass.hInstance  = hInstance ;
        wndclass.hIcon       = LoadIcon (NULL, IDI_APPLICATION) ;
        wndclass.hCursor     = LoadCursor (NULL, IDC_ARROW) ;
        wndclass.hbrBackground = GetStockObject (WHITE_BRUSH) ;
        wndclass.lpszMenuName = szAppName ;
        wndclass.lpszClassName = szAppName ;

        RegisterClass (&wndclass) ;
    }
    hwnd = CreateWindow (szAppName, "Unicode Character Set",
                        WS_OVERLAPPEDWINDOW | WS_VSCROLL,
                        CW_USEDEFAULT, CW_USEDEFAULT,
                        CW_USEDEFAULT, CW_USEDEFAULT,
                        NULL, NULL, hInstance, NULL) ;

    ShowWindow (hwnd, nCmdShow) ;
    UpdateWindow (hwnd) ;

    while (GetMessage (&msg, NULL, 0, 0))
    {
        TranslateMessage (&msg) ;
        DispatchMessage (&msg) ;
    }
    return msg.wParam ;
}

long APIENTRY WndProc (HWND hwnd, UINT message, UINT wParam, LONG lParam)
{
    static CHOOSEFONT cf ;
    static int        iPos ;
    static LOGFONT     logfont ;
    char              szBuffer [8] ;
    HDC               hdc ;
    int               cxChar, cyChar, x, y, i, cxLabels ;
    PAINTSTRUCT       ps ;
    SIZE              size ;
    TEXTMETRIC        tm ;
    WCHAR             ch ;

    switch (message)
    {
        case WM_CREATE:
            hdc = GetDC (hwnd) ;
            logfont.lfHeight = - GetDeviceCaps (hdc, LOGPIXELSY) / 6 ;
            strcpy (logfont.lfFaceName, "Lucida Sans Unicode") ;
            ReleaseDC (hwnd, hdc) ;

            cf.lStructSize = sizeof (CHOOSEFONT) ;
            cf.hwndOwner  = hwnd ;
            cf.lpLogFont  = &logfont ;
            cf.Flags       = CF_INITTOLGFONTSTRUCT | CF_EFFECTS |
                            CF_SCREENPENTS ;

            SetScrollRange (hwnd, SB_VERT, 0, 255, FALSE) ;
            SetScrollPos   (hwnd, SB_VERT, iPos, TRUE) ;
            return 0 ;

        case WM_COMMAND:
            switch (wParam)
            {
                case IDM_FONT:
                    if (ChooseFont (&cf))
                        InvalidateRect (hwnd, NULL, TRUE) ;

                    break ;
            }
            return 0 ;

        case WM_VSCROLL:
            switch (LOWORD (wParam))
            {
                case SB_LINEUP:      iPos -= 1 ; break ;
                case SB_LINEDOWN:    iPos += 1 ; break ;
                case SB_PAGEUP:      iPos -= 16 ; break ;
                case SB_PAGEDOWN:    iPos += 16 ; break ;
                case SB_THUMBPOSITION: iPos = HIWORD (wParam) ; break ;

                default:
                    return 0 ;
            }

            iPos = max (0, min (iPos, 255)) ;

            SetScrollPos (hwnd, SB_VERT, iPos, TRUE) ;
            InvalidateRect (hwnd, NULL, TRUE) ;
            return 0 ;

        case WM_PAINT:
            hdc = BeginPaint (hwnd, &ps) ;

            SelectObject (hdc, CreateFontIndirect (&logfont)) ;
            SetTextColor (hdc, cf.rgbColors) ;

            GetTextMetrics (hdc, &tm) ;
            cxChar = tm.tmMaxCharWidth ;
            cyChar = tm.tmHeight + tm.tmExternalLeading ;

            cxLabels = 0 ;

            for (i = 0 ; i < 16 ; i++)
            {
                wprintf (szBuffer, "00001X: ", i) ;
                GetTextExtentPoint (hdc, szBuffer, 7, &size) ;

                cxLabels = max (cxLabels, size.cx) ;
            }

            for (y = 0 ; y < 16 ; y++)
            {
                wprintf (szBuffer, "003X: ", 16 * iPos + y) ;
                TextOut (hdc, 0, y * cyChar, szBuffer, 7) ;

                for (x = 0 ; x < 16 ; x++)
                {
                    ch = (WCHAR) (256 * iPos + 16 * y + x) ;
                    TextOutW (hdc, x * cxChar + cxLabels,
                               y * cyChar, &ch, 1) ;
                }
            }

            DeleteObject (SelectObject (hdc, GetStockObject (SYSTEM_FONT))) ;
            EndPaint (hwnd, &ps) ;
            return 0 ;

        case WM_DESTROY:
            PostQuitMessage (0) ;
            return 0 ;
    }
    return DefWindowProc (hwnd, message, wParam, lParam) ;
}

```

Figure 4: UNICHAR.C shows how to mix ASCII and Unicode functions to display a Unicode font.

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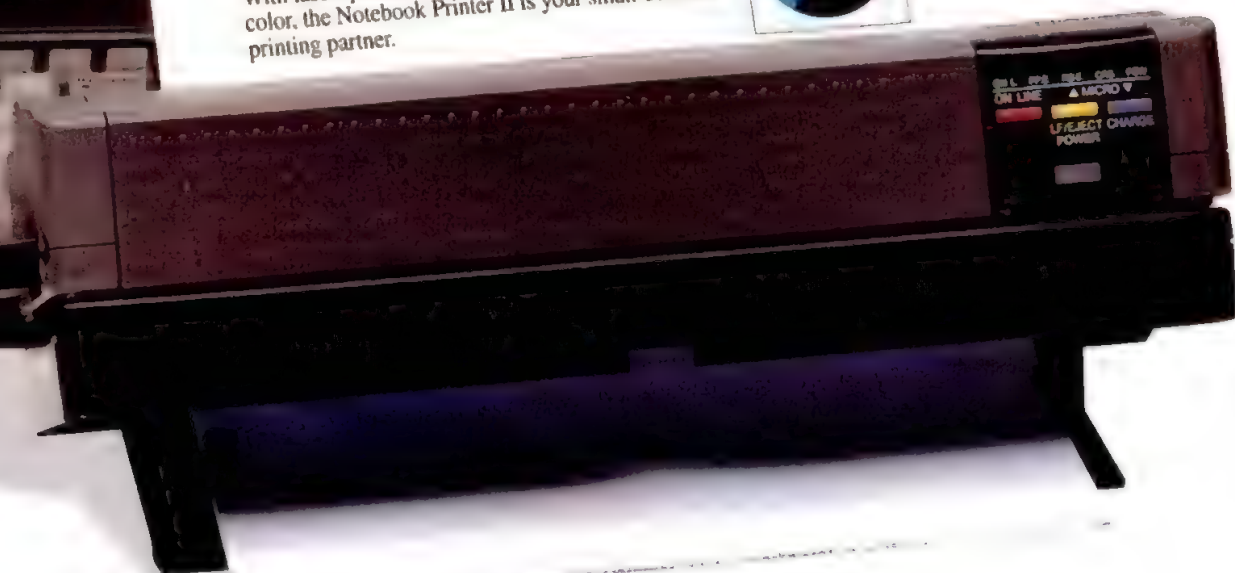
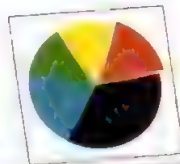
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CIRCLE 041 ON READER SERVICE CARD

A Unicode TrueType Font

Character Codes	Alphabet or Symbol Set
0x0000 - 0x00FF	ASCII and Latin 1
0x0100 - 0x01FF	European Latin, Extended Latin
0x0250 - 0x02FF	Standard phonetic, modifier letters
0x0300 - 0x036F	Generic diacritical marks
0x0370 - 0x03FF	Greek
0x0400 - 0x04FF	Cyrillic (subset)
0x0590 - 0x05FF	Hebrew
0x2000 - 0x20CF	Punctuation, sups, subs, currency
0x2100 - 0x214F	Letterlike symbols
0x2190 - 0x21FF	Arrows
0x2200 - 0x22FF	Mathematical operators
0x2300 - 0x23FF	Miscellaneous technical (subset)
0x2400 - 0x243F	Control pictures
0x2500 - 0x25FF	Form and chart symbols, blocks, shapes

Figure 5: The alphabets and symbol sets included in the Lucida Sans Unicode font.

```
#ifndef UNICODE
#define TextOut TextOutW
#else
#define TextOut TextOutA
#endif
```

Thus, all the TextOut function calls that appear in your program will actually be TextOutW functions if the UNICODE identifier is defined, and TextOutA functions if it's not defined.

So, the first steps to converting an existing Windows or Windows NT program to be compilable for either Unicode or ASCII are:

- Replace all your char, CHAR, and PCHAR data types to TCHAR and PTCHAR, as appropriate. Make sure that you don't use BYTE data types (or their relatives) to define character strings. If you've done so, you can change these to TBYTE.
- Enclose all quoted character strings in a TEXT macro.
- If your program also contains C runtime library functions that use character strings, you should follow the instructions shown in the last issue to convert these to the names defined in TCHAR.H.

Then, you can compile for Unicode by defining the UNICODE identifier (and also the _UNICODE identifier if you use TCHAR.H) or for ASCII by not defining these identifiers.

This is not the extent of the changes you may have to make. Some programs implicitly assume that a character is 8 bits

wide. Watch out for that! It could be a problem, particularly when you're writing text strings to a file or reading them. Also, some messages to window procedures are a little different, depending on whether the window class is defined as an ASCII or Unicode class. That depends on whether the window class was originally registered using RegisterClassA or RegisterClassW. We'll see how this works in a future column.

You may be wondering: What about resources? After all, resources such as menu and dialog box templates usually contain character strings. I

mentioned earlier that Windows NT supports Unicode from the ground up; this is one example. Strings in compiled resource files are always stored as wide characters, as you can easily determine by doing a hexadecimal dump of an .RES (compiled resource) file, or even an .EXE file containing resources. You'll see the normal character bytes of your ASCII strings separated by zeros, which means that they've been converted to Unicode by the resource compiler. If you load a resource using (for example), the LoadMenuW function, then the Unicode string comes in directly. If you use LoadMenuA, then the string is converted to ASCII by dropping every other byte in the string. If you use the normal LoadMenu name, then whether LoadMenuW or LoadMenuA is called depends on whether the UNICODE identifier is defined.

MIXING ASCII AND UNICODE In a future issue, we'll see an example of writing a Windows NT program that can be compiled for either ASCII or Unicode. Today, however, we'll mix ASCII and Unicode to display all the characters of a TrueType Unicode font.

The TrueType font that supports Unicode extensions is called "Lucida Sans Unicode." This name confused me at first because I interpreted it as "Lucida Without Unicode," but the

name is more accurately translated as "Lucida Sans Serif With Unicode." After installing Windows NT, you should see this font name listed in font-selection dialog boxes in programs such as Write. If not, you'll have to install the font manually from the NT CD-ROM using the Fonts section of the Control Panel. Unfortunately, this particular TrueType font is not very attractive and contains only a small subset of Unicode. A complete Unicode font would occupy (by my very rough estimate) something like 5 or 10 megabytes of hard disk space. I'm still trying to track down a complete Unicode font, but for the time being, we can experiment with Lucida Sans Unicode.

The UNICHAR program that can display all the Unicode characters of a font is shown in Figures 1 through 4. Although the program uses Lucida Sans Unicode by default, it includes a font-selection dialog box that lets you pick any TrueType font. UNICHAR is essentially still an ASCII program, but it's definitely Unicode-aware. The program from which it is derived simply displayed the 256 characters of a font in the client area of the program's window. UNICHAR, on the other hand, needs the capability to display 65,536 characters. For this reason, it includes a vertical scroll bar to select one of 256 pages, each displaying 256 characters. To display the Unicode characters, the program explicitly calls the TextOutW function, using as an argument a pointer to a character defined with the WCHAR data type. But that's really the only extent to which the program uses Windows NT Unicode support. (You can download the program and source code

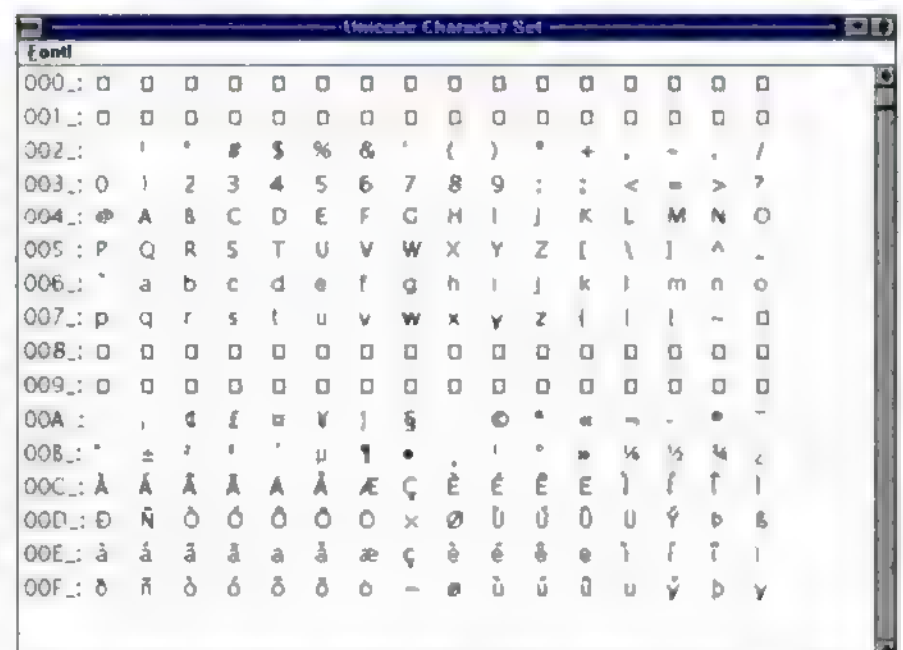


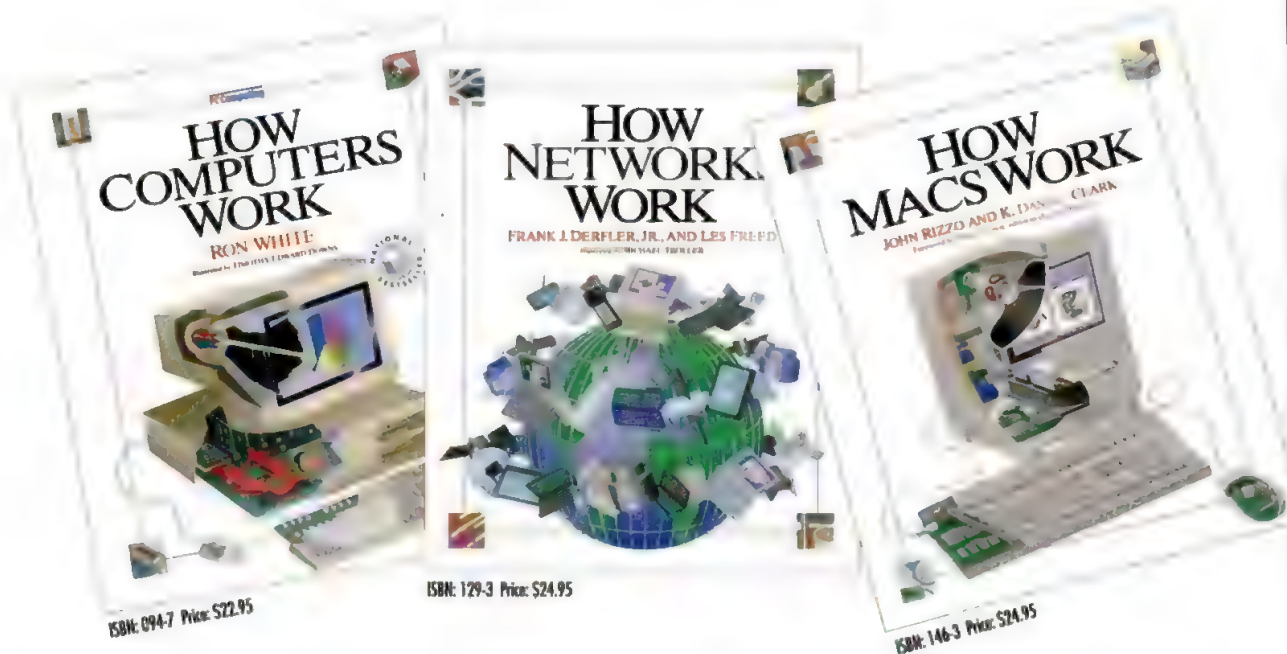
Figure 6: The ASCII and Latin 1 alphabets displayed by the UNICHAR program.

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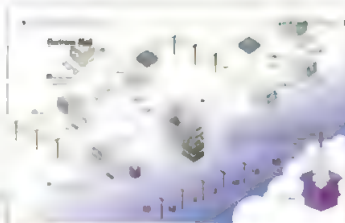


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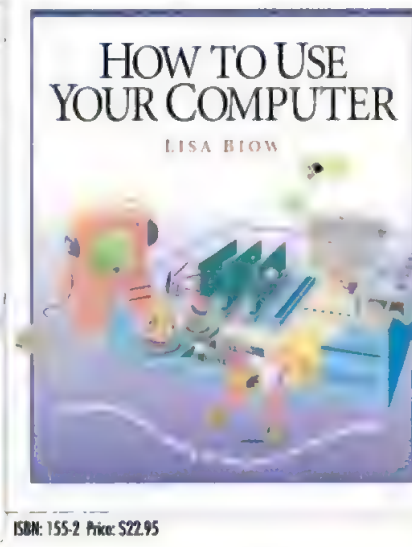
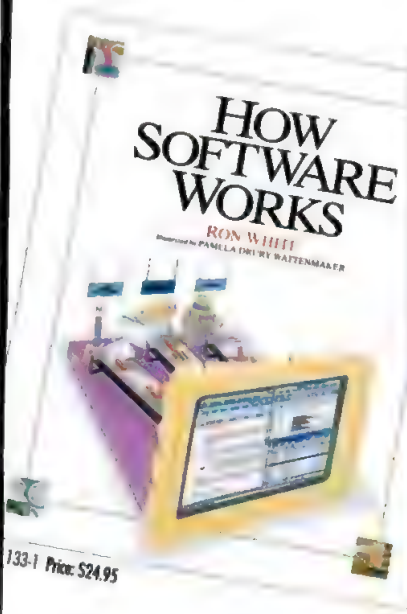
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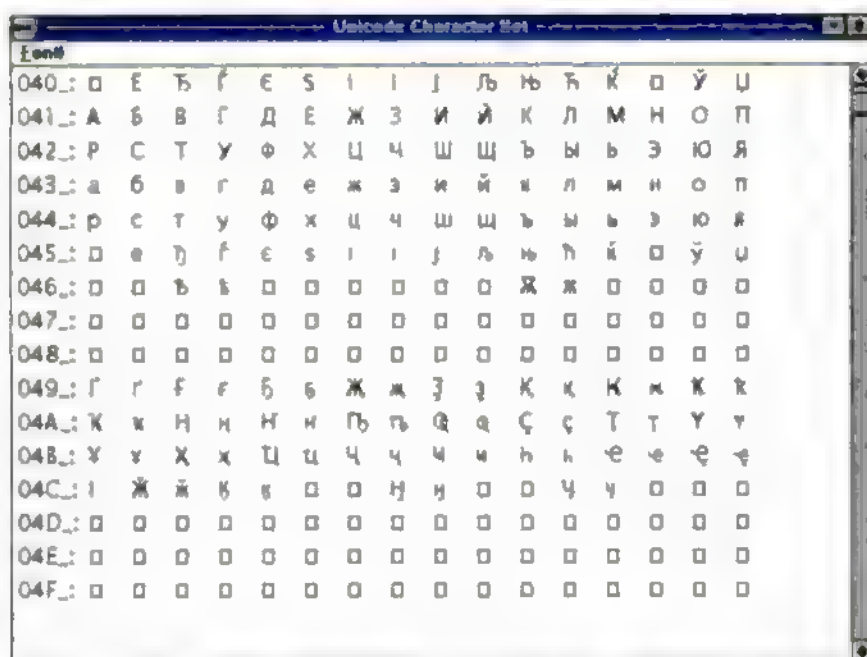


Figure 7: The Cyrillic alphabet displayed by the UNICHAR program.

files for UNICHAR from PC MagNet archived as UNICHA.ZIP).

A CLOSER LOOK As I mentioned, UNICHAR lets you invoke a font selection dialog box; in the future you might be able to select a more extensive Unicode font than Lucida Sans Unicode. UNICHAR.C manages to be a lot shorter than it would normally be because it uses the ChooseFont function in the Common Dialog Box library.

During the WM_CREATE message, UNICHAR first initializes the fields of a LOGFONT structure for Lucida Sans Unicode font. All the fields of the structure are set to zero except the typeface name and the font height. I set the font height to 12 points, which I found empirically to be the largest point size that allows an entire block of 256 characters to fit in the client area when the window is maximized. UNICHAR also initializes several fields of the CHOOSEFONT structure at this time.

The final job during WM_CREATE

program can refresh the screen using the new font.

The WM_VSCROLL processing is equally simple—the program increments or decrements the iPos variable depending upon the mouse actions on the scroll bar. (To keep the program short and simple, I didn't include a keyboard interface.) This determines the 256-character page to be displayed in the client area.

During the WM_PAINT processing, UNICHAR creates the logical font and selects it into the device context. It also uses the rgbColors field of the CHOOSEFONT structure to set the text color that the user may select from the font selection dialog box.

Each page of 256 characters is displayed in a 16-by-16 grid, with consecu-

message processing is to initialize the scroll bar to a range of 0 through 255. These values refer to the 256-character page that will be displayed in the program's client area.

If the user selects "Font" from the program's menu, UNICHAR simply calls ChooseFont while processing the WM_COMMAND message, and then invalidates the client area if the user clicks the "OK" button on the dialog box. This generates a WM_PAINT message so the

function is similar to the GetTextExtent function in DOS-Windows except that it returns the text extents in a SIZE structure. UNICHAR then loops through each row of the display by first displaying the label using TextOut. Because the UNICODE identifier has not been defined in this program, TextOut simply maps to TextOutA.

To display the actual Unicode characters, UNICHAR uses a variable called ch (character) defined to be of type WCHAR. Depending on the selected page and the x and y coordinates of the grid, the value of ch could range from 0 through 65,535. The program displays the character by explicitly calling the TextOutW function.

ALPHABETS AND SYMBOL SETS If you have Volume 1 of The Unicode Standard, Version 1.0 (Addison Wesley, 1991), you

can compare the documented characters with what you see in the UNICHAR window. Unfortunately, the people who put together this reference chose to arrange their tables with consecutive character codes increasing from top to bottom and

*To display the actual
Unicode characters,
UNICHAR uses a variable,
ch (character), defined
to be of type WCHAR.*

then left to right—just the opposite of the configuration I used. That arrangement facilitates the identification of the alphabet sets in the manual, but I think my approach is more rational.

When looking at the output from UNICHAR, you'll see many characters represented by an outlined square. These are character codes for which Unicode does not define characters or which are not supported by the Lucida Sans Unicode font.

The table in Figure 5 shows the various alphabets and symbol sets included in the Lucida Sans Unicode subset. Many of these alphabets are based on existing ANSI or ISO standards, which are documented in the Unicode Standards books. In case you don't have Windows NT to run the UNICHAR program, Figures 6, 7, and 8 show some sample screens. That should be enough to whet your appetite, I hope. Unicode is real, it's here, and it works. □

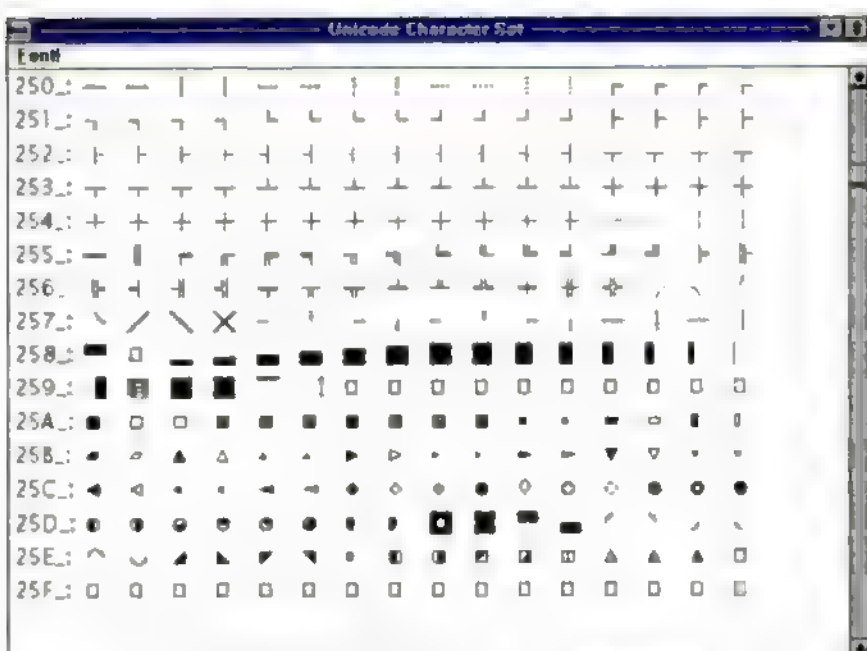


Figure 8: The form and chart symbols, blocks, and geometric shapes displayed by the UNICHAR program.

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*Jacob Milinsky
New York, New York*

► **PC MAGAZINE:** It's difficult to define "American-made" since so many components are made in other countries. You can find a large number of computer systems from American companies, however, that have power supplies designed to work with both 110 and 220 volts.

You might want to consider getting a laptop computer instead of a desktop system, though. First, you won't have the problem of finding a monitor that works on both voltages (these are not as common as the dual-voltage desktop units). With a laptop, the display and computer share the same power source, and for many laptop systems the power transformer can automatically adjust to either 110- or 220-volt electricity. Add to this the compact size of a laptop (which could be a significant advantage aboard a ship), and it should be well worth the premium you'll pay for it.

Traveling landlubbers who plan to visit abroad may also prefer to use laptops instead of desktops for similar reasons. For more tips about traveling with computers, see "Your Portable Laptop Guide," *PC Magazine*, August 1992.

—Alfred Poor

FINDING ROOM FOR EXTRA DRIVES

❓ I'd like to get an expansion chassis for my computer system. I want to use it for additional hard disk drives, tape backup, and a CD-ROM, but I can't figure out how to do it. Do I have to set up a separate system and communicate with it across a COM port?

*Joe Vlahovic
Lockport, Illinois*

► **PC MAGAZINE:** You can purchase these devices in their own, separate external enclosures, but it's not a great idea. Doing so would create a cabling snarl and would take up more space than if you used an expansion chassis. Expansion boxes were common accessories for early PCs, but now you usually find them offered as docking stations for notebook computers. They're still available from third-party sources such as APPRO International (Santa Clara, CA; 408-732-6091). These devices connect to an ex-

pansion slot in your existing system, essentially giving you more slots in another box with an additional power supply.

You may also want to consider replacing your computer case entirely. For about the same money as an expansion chassis, you can purchase a new tower case which should have plenty of room for your disk drives, CD-ROM drives, and tape backup. This will help eliminate any RF emissions or other electrical noise which can be a problem when connecting to an external device, and it will also provide much faster performance than you would get across a serial network arrangement.—Alfred Poor

Peripherals

KEEP YOUR PRINTER FROM PRINTING BLANK PAGES

❓ We installed a printer-sharing device so that our computers could share an HP LaserJet II. The printer now ejects a

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See index, page 395.

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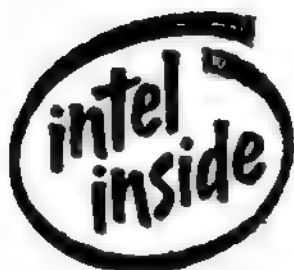
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blank page after completing a print request, and if we try to reuse this paper in the paper tray, it gets jammed. Is there any way to avoid wasting all this paper?

Richard Wilson
Chester, Virginia

► **PC MAGAZINE:** The first step is to double-check the documentation for your printer-sharing device. Most devices of this sort have a configuration setting that lets you choose whether or not to send a page eject at the end of each print job. If this option is available, simply turn off the extra page eject.

This feature is included in sharing devices because many applications predate the advent of the low-cost laser printer, when most people used dot matrix or daisywheel printers that would print each line of text as it was received. Programs such as dBASE or Lotus 1-2-3 didn't send a page eject at the end of the print job since the user could either tear off the paper right at that point or advance the paper manually.

In contrast, laser printers don't produce a page until they are told that the page is finished. As a result, an older program that sends text without a page eject

will leave data sitting in the laser printer's page buffer. The next print job that comes along will be added to the first data, and when the page fills, you may have a mix of two or more print jobs. To prevent this, most printer-sharing devices can be set to force a page eject at the end (or beginning) of each print job. If your applications have their own page-eject commands, this becomes redundant and the blank pages pile up.

If your sharing device already has the automatic page-eject feature turned off, you could have a different problem. Many programs use line-feeds instead of

Our Advisors

Douglas Boling is a contributing editor and the author of many utilities, including MBOOT.COM and EMS40.SYS.

Frank J. Derfler, Jr., is senior networking editor and the author of the *PC Magazine Guide to Connectivity*.

Alfred Poor is a contributing editor and the author of *New Life for Old PCs*.

Jeff Presise is a contributing editor and the author of the *PC Magazine Guide to DOS 5 Memory Management*.

Sal Ricciardi is a contributing editor and the author of the recent *Running FoxPro* books from Microsoft Press.

Nell Rubenking is technical editor and author of *Can Do DOS*,

Can Do Windows, and *PC Magazine Batch File Lab Notes*.

Joe Salemi is a contributing editor and the author of the *PC Magazine Guide to Client/Server Databases*.

Luisa Simone is a contributing editor and the author of the book *Microsoft Publisher*.

Craig Stinson is a contributing editor and coauthor of *Running Windows 3.1* and *Running Microsoft Excel*.

M. David Stone is a contributing editor and coauthor of *Word for Windows Companion*, Second Edition.

Ethan Winer is a contributing editor and the author of *PC Magazine BASIC Techniques and Utilities*.

a form-feed character (ASCII 12) to advance to the top of the next page. If too many line-feeds are sent to a laser printer, the blank lines sit in the printer's page buffer and will be added to the next set of data sent to the printer. This problem is not uncommon, since most applications expect to print 66 lines on a page, but most laser printers are set by default to have only 63 printable lines on the page. Under most conditions, this will simply cause the next print job to start lower on the page. But a problem arises if the printer-sharing device or the sending application starts the next print job with a printer reset command (Escape E under PCL). If there is any data in the printer's buffer when this command is received, a page is printed before any more data is accepted by the printer. If the data in the buffer happens to be blank lines, the printed page will, of course, be blank. (If there is data waiting in the printer's buffer at the end of a print job, the Form Feed light will stay on.)

The best solution to this problem is to reconfigure your applications so they stop sending the extra blank lines at the end of a page. This usually entails adjusting either the page length or margin settings. A less successful alternative would be to turn off the printer reset command, which may only be possible if it is being provided by the printer-sharing device. This option would leave the blank lines at the top of the page, resulting in blank space at the top of the next print job.

Finally, it's possible that the extra pages are being created by the printer-sharing device, and that there is no way to turn it off. In this unlikely and unfortunate circumstance, your only solution is

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to dump the equipment and get a printer-sharing system that is better behaved.

—Alfred Poor

Operating Environments

SETTING A REALLY LONG PATH

► **PC MAGAZINE:** You can't have more than 127 characters in a DOS command, whether you type it at the command line or insert it in a batch file. Thus the longest path statement you can set with the PATH= command is 122 characters (127 minus the five characters in "PATH="). From the letters I receive, it's clear that a lot of DOS users would like to use a longer path. Until now, all I've been able to suggest is *shortening* the names of directories on the path, either by using one- or two-letter names or by using SUBST to replace directory names with drive letters. Well, with DOS 6.0 you can make the path as long as you want! The usual caution applies, of course—the longer

you make the path, the longer it takes DOS to search it.

The key to setting a long path in DOS 6.0 is that you can now use the SET command in CONFIG.SYS, and there's no limit on the length of CONFIG.SYS lines. Just add the line SET PATH= followed by a path of *any* length, up to the maximum environment size specified in the SHELL= line. Of course, you'll need an editor that can handle such a long line. DOS's own EDIT allows lines up to 256 characters, and that may well be enough for most users.

Once you've created an extra-long path using SET in CONFIG.SYS, though, you have to give up any further manipulation of the path. Batch files that append directories to the path, save and restore the path, or in any way manipulate the path will truncate it to 122 characters, and the PATH and SET commands will display only the first 122 characters of the path. But DOS *will* search all directories on an extra-long path, and that's what's important.

—Neil J. Rubenking

WHAT'S ENOUGH MEMORY IN WINDOWS?

❗ I have a 386/40 DX with 4MB RAM, and I'm running Windows 3.1 with DOS 5.0. I haven't had any UAEs yet, but I have had Insufficient Memory messages popping up frequently. I don't understand whether you have to add more extended memory when this message appears, since the message really means insufficient conventional memory. If all programs require conventional memory (640K), why do we need extended memory at all? And how come DOS *still* has this 640K barrier?

Anand R. Sheth

Los Angeles, California

► **PC MAGAZINE:** All DOS-based programs do require conventional memory, but some contain special DOS-Extender code that lets them use extended memory as well. Also, computers that have a 386 or better CPU can be put into a special mode called *Virtual 8086* mode. In this

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mode the processor parcels out chunks of extended memory to "virtual machines." Within a given virtual machine, the extended memory "looks" just like conventional memory, and ordinary DOS programs run fine. Multitasking systems like DESQview use this Virtual 8086 mode.

Windows applications, on the other hand, don't rely on conventional memory. They let Windows handle all the memory management, and Windows uses both conventional and extended memory. When you run a DOS-based program under 386 Enhanced mode Win-

amount of RAM you have installed.

When you get the insufficient memory message, bring up Program Manager's Help menu and click About. The resulting dialog box will list the amount of free RAM and the percentage of FSRs. If the latter is 10 percent or lower, you're almost certainly running out of FSRs. The only solution then is to close some of the running programs.—Neil J. Rubenking



ASSIGNING ALT-HOTKEYS IN WINWORD

TIP The vast majority of Microsoft Word for Windows users who prefer keyboard shortcuts over maneuvering and clicking the mouse have probably discovered that WinWord lets you assign shortcut keys to any commands or macros you like, through the Keyboard category in the Options dialog box. One shortcoming, however, is that you can't assign any combination that uses the Alt key. Given that WinWord 2.0 can only recognize shortcuts composed of single key combinations, you can quickly run out of mnemonics and be forced to use arbitrary—and hard to remember—keys.

Despite this limitation in the Options dialog box, WinWord can actually take advantage of Alt key combinations, and even Alt-Ctrl, Alt-Shift, and Alt-Ctrl-Shift combinations. What's more, Win-

Word 2.x ships with a macro called InstallMacro that, with some minor alterations, will let you assign virtually any combination of an alphanumeric key plus Shift, Alt, and Ctrl to any macro or command that you want.

You can find InstallMacro in the file NEWMACRO.DOC, which should be in your WinWord program directory. To take advantage of it, you will first need to install the macro in a template—usually NORMAL.DOT. Simply open NEWMACRO.DOC, highlight InstallMacro in the Macro Name list, and choose Install. Then enter NORMAL in the Template text box, optionally enter a menu or shortcut key to attach the macro to, and choose OK.

The dialog box you'll see when you install InstallMacro is similar to the one you'll see when you run the macro itself. Notice that you'll find choices in this dialog box to let you assign any combination of Ctrl, Shift, and Alt along with an alphanumeric key (or certain other keys, including function keys).

As shipped, InstallMacro will let you assign keystrokes only to macros, and only when you copy or move macros between templates. To modify it so you can assign shortcuts to built-in commands or to macros without copying or moving them, start by choosing ToolsMacro, and choosing Global Macros in the Show box. Then enter InstallMacro in the Macro Name text box, and choose Edit.

Use WinWord's usual commands to search for MacroCopy. You should find a line that reads

Old Dialog Box Code in InstallMacro

```
Begin Dialog UserDialog 510, 331
  Text 16, 7, 124, 13, "Macro to &Install:"
  ListBox 16, 25, 344, 87, rgMacros$, .Macro
  GroupBox 17, 120, 389, 202, "Copy/Move to"
  Text 36, 134, 76, 12, "&Template:"
  ComboBox 36, 152, 160, 108, Template$, .Template
  Text 221, 135, 48, 12, "Me&nu:"
  ComboBox 221, 152, 160, 108, Menu$, .Menu
  GroupBox 35, 267, 348, 45, "Shortcut Key"
  CheckBox 47, 285, 75, 16, "Ctrl +", .Ctrl
  CheckBox 121, 285, 84, 16, "Shift +", .Shift
  CheckBox 202, 285, 64, 16, "Alt +", .Alt
  Text 268, 287, 35, 16, "&Key:"
  TextBox 314, 284, 53, 18, .Key
  PushButton 391, 14, 88, 21, "&Copy"
  PushButton 391, 39, 88, 21, "&Move"
  CancelButton 391, 65, 88, 21
End Dialog
```

Figure 1: The code for the dialog box in InstallMacro no longer matches the function of the macro after you modify it to assign shortcut keys.

*The memory addressing
system that's built
into the very atoms
of DOS is utterly
unable to handle more
than 1MB of memory.*

dows, that program runs in a virtual machine.

The 640K barrier you mention doesn't actually exist; the *real* barrier is at the 1MB level. By convention, the top 384K of that 1MB is reserved for video buffers, ROM BIOS, and adapter ROM. The memory addressing system that's built into the very atoms of DOS is utterly unable to handle more than 1MB of memory. Removing this limitation from DOS would result in something that just *isn't* DOS any more—it wouldn't run existing DOS programs.

As for the insufficient memory message, it probably doesn't mean insufficient conventional memory. You may be running a DOS-based program with a PIF file that doesn't specify a high enough value for KB Required. You may simply be running so many Windows applications that all of your available memory is in use, in which case more extended memory would solve the problem. Or you may have plenty of memory but not enough free system resources (FSRs). FSRs come from a fixed-size pool in Windows itself that's not dependent on the

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Modified Dialog Box Code for InstallMacro

```
Begin Dialog UserDialog 510, 331, "Reassign Keys"
  Text 16, 7, 160, 13, "&Macro or Command:"
  ListBox 16, 25, 344, 87, rgMacros(), .Macro
  GroupBox 17, 120, 389, 202, "Assign in:"
  Text 36, 134, 76, 12, "&Template:"
  ComboBox 36, 152, 160, 108, Template(), .Template
  GroupBox 35, 267, 348, 45, "Shortcut Key"
  CheckBox 47, 285, 75, 16, "Ctrl+", .Ctrl
  CheckBox 121, 285, 84, 16, "Shift+", .Shift
  CheckBox 202, 285, 64, 16, "Alt+", .Alt
  Text 268, 287, 35, 16, "&Key:"
  TextBox 314, 284, 53, 18, .Key
  PushButton 391, 14, 88, 21, "&Assign"
  CancelButton 391, 65, 88, 21
End Dialog
```

Figure 2: You can easily modify the dialog box definition shown in Figure 1 to match the new behavior of the macro.

```
MacroCopy Src$ + ":" + Macro$,
  Template$ + ":" + Macro$
```

Delete this line. Then go back to the beginning of the macro. Starting at the sixth line, you should see the following three lines:

```
SrcContext=1 '1=Template; 0=Global
cMacros=CountMacros(SrcContext)
If cMacros=0 Then SrcContext=0 :
cMacros=CountMacros(SrcContext)'
```

Add a new line after the first of these lines, reading:

```
All = 1
```

Then change the next line to read:

```
cMacros = CountMacros(SrcContext,
  All)
```

And the last part of the line after that to read:

```
... = CountMacros(SrcContext, All)
```

Finally, three lines after this, you should find the line:

```
rgMacros$(j) = MacroName$(i,
  SrcContext) : j = j + 1
```

Change this line so the middle part reads:

```
... = MacroName$(i, SrcContext,
  All)...
```

By adding All in these lines, and defining

All as equal to 1, you are telling WinWord to list all the built-in commands along with macros.

You can now save and close the macro. Also be sure to save the changes to NORMAL.DOT, with FileSave All. When you run the macro from now on, you can assign any key combination to macros or commands by choosing the macro or command in the Macro To Install list box, specifying NORMAL (or another template, as appropriate) in the Template list box, specifying the shortcut key, and choosing Copy.

*Claude Thomassin
Benglen, Switzerland*

► **PC MAGAZINE:** The modified macro works as described and can certainly be useful. But unless you make a few more changes, it's best understood as a quick-and-dirty answer that is also potentially dangerous. The problem is that once you remove the MacroCopy command—as you have to if you want to assign keystrokes without copying a macro to a different template—the macro's behavior no longer matches the dialog box text.

To choose the macro or command to assign a key to, for example, you have to choose from the list box labeled *Macro to Install*; to choose the template to assign the keystroke to, you have to choose from within a box labeled *Copy/Move to*; and to actually assign the keystroke, you have to choose a button labeled *Copy*. To complicate matters

further, the menu list box no longer serves any purpose in context of assigning keystrokes. Even the original name of the macro is misleading, since it no longer installs macros but reassigns keys.

The easy way to avoid any confusion is to redesign the dialog box and either rename the macro or, even better, keep the untouched original as InstallMacro and make the changes in a second copy that has a more descriptive name, such as ReassignKeys.

To create ReassignKeys, start by installing InstallMacro in NORMAL.DOT, as Mr. Thomassin describes, then open the macro for editing and use WinWord's usual editing commands to copy the entire macro to the Clipboard.

Next, close InstallMacro, choose ToolsMacro, enter a name, such as ReassignKeys, in the Macro Name text box, and choose edit. WinWord will open the macro editing window with a Sub MAIN and End Sub statement. You'll need to delete these—either before or after you paste the text from the Clipboard—since the text in the Clipboard already contains these two lines.

Once you've pasted the macro text, modify it as Mr. Thomassin describes. Then look for the dialog box section shown in Figure 1 and change it to match Figure 2. If you compare the two, you'll see that Figure 2 adds the title Reassign Keys in the title bar, deletes the Move button and all references to menus, and changes a few labels to match what the macro is actually doing—renaming the Copy button to Assign, for example. The resulting dialog box is in Figure 3. (You should also note that the lines in Figure 2 change the horizontal length that is

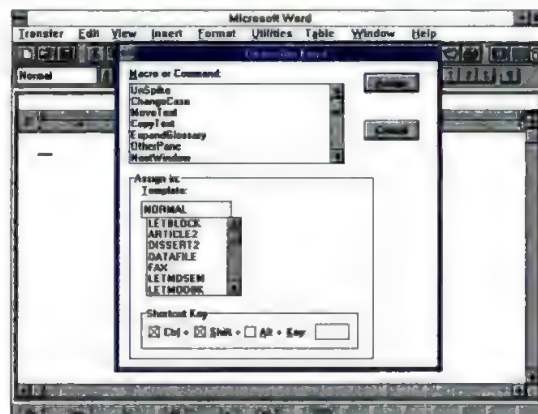


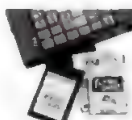
Figure 3: The dialog box produced by the code in Figure 2.

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specified in the first Text command.)

There are any number of other changes you might want to make to this macro—more than there is room to even list here. But there are several additional issues that demand mention. Note that once you've made these changes, you can also delete large portions of the macro that no longer serve any purpose. You may find it an instructive exercise to read through the macro and clear out the deadwood. On the other hand, it doesn't do any harm to leave the extra lines in.

Much more important from a practical viewpoint is that this macro, unlike the Options dialog box, will not warn you when you're about to assign a keystroke that's already assigned to something else. That means you have to be careful when you assign keys. You might even want to continue using the Options dialog box for most key assignments, and limit this macro strictly to assigning Alt-key combinations.

Finally, note that you can also assign Alt combinations to keys with the Tools-OptionsKeyboard command. The command is fully explained in the help system and in the *Using WordBasic* manual.

—M. David Stone

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ESC IN 1-2-3 MACRO MENUS

TIP My job entails writing small engineering programs in 1-2-3 for my colleagues. Some of these programs require the use of custom menus. Typically the programs need to continue after the user has made a menu selection, so {menucall}, rather than {menubranch} seems like the appropriate way to create the menu.

However, {menucall} presents one problem. My menus typically get input from the user and store that input in a blank cell. If the user presses Esc instead of selecting a menu item, the input cell remains blank, and this can lead to errors in calculation.

I have solved the problem by using {menubranch}, even though {menucall} at first seemed like the logical choice. I store the {menubranch} instruction itself in a subroutine, and after the {menubranch}

ESCMENU.WK1				
Complete Listing				
A	B	C	D	
1 \A	{goto}c1~	Number 'A' =	1000	
2	Number 'A' = ~{r}/xnEnter No. A: ~{1}{d}	Number 'B' =	2000	
3	Number 'B' = ~{r}/xnEnter No. B: ~{1}{d}	Divider 'C' =	2	
4	Divider 'C' = ~{r}{ROUTINE}{1}{d}	The Result =	1500	
5	The Result = ~{r}+(d1+d2)/d3~6			
7				
8 ROUTINE	{menubranch SELECT}{branch ROUTINE}			
10 SELECT	2	3	4	
11	Divide by 2	Divide by 3	Divide by 4	
12	2~	3~	4~	

Figure 4: This 1-2-3 macro prompts you for numbers, presents a menu, and performs a calculation based on your entry. Its menu ignores the Esc key.

instruction I write a {branch} to the {menubranch}! This arrangement, exemplified by Figure 4, nullifies the effect of the Esc key.

I think this technique could be useful to other readers who create 1-2-3 macros involving compulsory selection of a menu item.

D.G.K. Murti
Doha, Qatar

►PC MAGAZINE: This is an effective way to disable the Esc key in a custom menu. The {ROUTINE} statement in line 4 of Mr. Murti's macro makes a subroutine call to the {menubranch} statement in line 7. If the user makes a menu selection, control passes to B11, C11, or D11, depending on which menu item the user has selected. The code in each of these cells puts a divisor into cell D3.

If the user presses Esc instead of making a selection, the next statement executed is {branch ROUTINE}, which simply reinvokes the custom menu. The user is thus unable to quit the menu (unless Ctrl-

Break is pressed to abort the process).

Because the macro arrived at the {menubranch} statement via a subroutine call—the {ROUTINE} statement in line 4—the macro picks up again in line 4 after the menu has finished doing its thing. Thus, Mr. Murti presents his menu and forces the user to use it. Line 5 of the macro then carries out the calculation based on the divisor selected from the custom menu.

Notice the problem that could arise if line 4 used

```
{menucall SELECT}
```

instead of

```
{ROUTINE}
```

If the user pressed Esc under these circumstances, control would pass directly to the remaining statements on line 4, and the macro would try to carry out the calculation using whatever happened to be in d3 before the macro started—an

ESCMENU2.WK1				
Complete Listing				
A	B	C	D	E
1 \A	{goto}c1~	Number 'A' =	35	
2	Number 'A' = ~{r}/xnEnter No. A: ~{1}{d}	Number 'B' =	65	
3	Number 'B' = ~{r}/xnEnter No. B: ~{1}{d}	Divider 'C' =	4	
4	Divider 'C' = ~{r}{ROUTINE}{1}{d}	The Result =	25	
5	The Result = ~{r}+(d1+d2)/d3~			
7 ROUTINE	{menubranch SELECT}{branch ROUTINE}			
9 SELECT	2	3	4	Start over
10	Divide by 2	Divide by 3	Divide by 4	Begin again
11	2~	3~	4~	{restart}{branch \A}

Figure 5: This macro is identical in function to the one in Figure 4, but this version's menu gives you a choice of starting over if you've entered an incorrect number.



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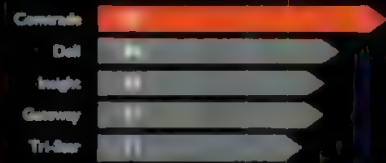
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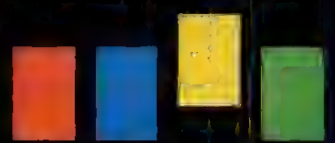


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undesirable outcome, to say the least.

Notice, too, that line 7 must be

```
{menubrand SELECT}{branch ROUTINE}
```

not

```
{menucall SELECT}{branch ROUTINE}
```

Were it the latter, control would always return to line 7, whether the user made a selection or pressed Esc. The user would be trapped forever inside the custom menu.

I have one embellishment to suggest. If you're going to disallow escape from your menu, it's a good idea to anticipate why a user might want to escape and to accommodate that need. In Mr. Murti's case, a user might be tempted to press Esc if he or she made a mistake in replying to the input prompts in lines 2 and 3. These lines use the /xn command (a pre-Release-2 equivalent for {getnumber}) to get numeric input from the user. A user who entered a wrong number might be tempted to press Esc in order to start over. Anticipating that possibility, the custom menu would do well to include a start-over option. Figure 5 shows one way that could be done.

Because the macro arrived at its menu code via a subroutine call, the start-over code must first do a {restart} to clear the subroutine stack. Then it can do its da capo by branching to \A. If you branch back to the start of the macro without issuing a {restart}, then the second call to {ROUTINE} becomes, in effect, a nested subroutine call—a subroutine within a subroutine. If you do this enough times, 1-2-3's macro interpreter dies of stack exhaustion.

You can download both macros from PC MagNet's Utilities/Tips forum archived as ESCMEN.ZIP.—*Craig Stinson*

tion. FoxPro evaluates the condition only up to the point at which it can determine whether the condition results in TRUE or FALSE.

For example, the following commands run without error in FoxPro:

```
LOCATE FOR .T. OR This-is-bogus
LOCATE FOR .F. AND This-is-bogus
IF .T. OR This-is-bogus
IF .F. AND This-is-bogus
```

All of these conditions will produce an error in dBASE III Plus.

The following are important consequences of this behavior:

A small program-execution speed gain can be realized by placing the condition most likely to determine the result in the first position.

A bug such as a misspelled variable name can lie dormant if the condition in which it appears normally completes before the variable name is reached.

*Kris Stange
Helena, Montana*

► **PC MAGAZINE:** This is often called "short-circuit" evaluation, or "lazy" evaluation. Basically this means that subexpressions, such as the text that appears on the right side of an AND or OR, are only evaluated when necessary. When is it necessary? Only when the outcome of the expression is still in question.

For example, consider the first LOCATE statement above, where the FOR expression is as follows:

```
.T. OR this-is-bogus
```

In this expression, as soon as you see the .T., the answer is known. That's because when you use the OR operator, the result of the expression is true if *either* side of the OR operator is true. So once FoxPro sees the .T., the result is already known and it skips the other expression, resulting in faster execution.

As Mr. Stange states, it makes sense to put the most-likely-to-be-true condition first in an OR expression, and the condition most likely to be false first in an AND expression. That way your program can take advantage of the slight speed improvement that results from short-circuit evaluation.

It's also true that an error such as a misspelled variable name will not be detected until FoxPro evaluates the expression in which it appears. If the expression is on the right side of a logical operator and usually isn't needed to determine the outcome, FoxPro skips it, thus ignoring the error.

dBASE III Plus does not perform short-circuit evaluation. As a result, if you have programs that rely on the right side of a logical expression being evaluated all the time (not a good programming practice), you will experience problems when porting the code to FoxPro or any other Xbase dialect that performs short-circuit evaluation. You must rewrite your code to avoid such constructs.—*Sal Ricciardi*

PARADOX CUT AND PASTE

✓ **TIP** There is no such thing as cut-and-paste when designing a report using Paradox 4.0. This makes for a lot of work when you're creating report groups that use calculated fields. For example, I often place the same calculated field in more than one band in a report. I might place it in a page band or table band, then add a summary calculated field in the footer of the group band. I might use the same calculated field in many groups, as well as in the report footer as a 'grand total'. Without a cut-and-paste option, I have to type in the calculated field many times. However, I've discovered that using the following steps will help save some work:

1. Place the calculated field in the report.
2. Move the cursor to the placed field and press Alt-F10 to bring up the PAL menu.
3. Select Miniscript. Then type

```
x = Fieldinfo()
```

and press Enter. You can substitute any variable name for x.

4. Place any additional bands in the report.
5. When you need to, begin placing another calculated field on the report. At the point when you have to enter the calculation, press Alt-F10 to bring up the PAL menu and select Miniscript. Then type

```
Typein x
```

Databases

FOXPRO'S LOGICAL SHORT-CIRCUITING

✓ **TIP** I have found an interesting property of FoxPro and FoxBASE+ concerning the way they evaluate a logical condi-

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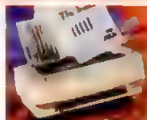
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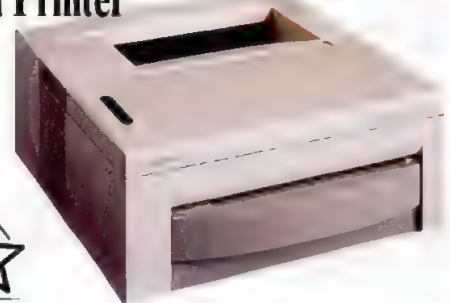
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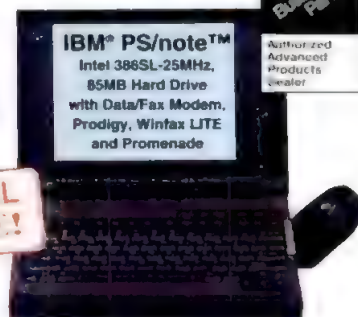
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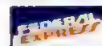


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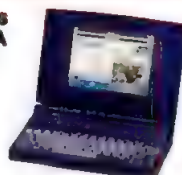
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and press Enter. The calculated field will now appear in the dialog box, and you can continue.

A similar routine can be used to copy formatting info. (I often draw lines using the Alt-Numeric keypad. For example, Alt-205 is double underline.) The `Cursorline()` function can be substituted in place of `Fieldinfo()` in the steps above to copy a line of text on the screen.

Bill Darron
Fair Lawn, New Jersey

► **PC MAGAZINE:** The `Fieldinfo()` function returns the current contents of the Form or Report Designer field indicator, which

You can use the Setkey command with Fieldinfo() to simulate cut-and-paste hotkeys for calculated fields.

is displayed at the bottom of the screen. When you're in a calculated field the field indicator displays the calculation, so that's what is returned by the `Fieldinfo()` function. You can save this value to a variable and then use the `Typein` command to type it back in when creating additional calculated fields that use the same calculation. This can save you some time, especially with a long or complicated calculated field. And you'll only have to get it right the first time you type it in.

You can use the `Setkey` command with `Fieldinfo()` to simulate cut-and-paste hotkeys for calculated fields. For example, consider the following:

```
Setkey 3 x=Fieldinfo()  
Setkey 22 Typein x Enter
```

The first line assigns the command

```
x = Fieldinfo()
```

to the Ctrl-C key. The second line assigns the command

```
Typein x Enter
```

to the Ctrl-V key. Once you've entered these commands, you can place the cur-

sor over a field and press Ctrl-C to copy it. Then later you can press Ctrl-V to paste it. Windows users will recognize that these hotkeys duplicate the Copy and Paste hotkeys found in that operating environment.—*Sal Ricciardi*

Graphics

CAPTURING SVGA IMAGES

► I bought Pizazz Plus 3.0 based on a *PC Magazine* review ("The Image Crusaders: 12 Screen Capture & Conversion Utilities," April 13, 1993). The line, "Maximum resolution for capture: Any Windows resolution, 16.8 million colors" led me to believe that Pizazz Plus 3.0 could capture and print any SVGA screen created by a DOS program. But I found that the product can capture only conventional VGA screens of 640 by 480 by 16 colors or 320 by 200 by 256 colors.

My problem is that I want to print fractals created by Fractint, a DOS graphics program. The SVGA images I produce with Fractint are 1,024 by 768 by 256 colors, and I've been unable to capture these images using Pizazz Plus. Can you tell me of a program that will let me capture and print high-resolution SVGA screens? I'd also like to import the Fractint images into other programs, such as Ami Pro 3.0 for Windows.

Heikki Hijer
Vaajakoski, Finland

► **PC MAGAZINE:** There are two solutions to your problem, neither of which requires you to purchase any additional software.

Contrary to your experiences, Pizazz Plus 3.0 (Application Techniques Inc., 508-433-5201) can capture SVGA screens of 1,024 by 768 by 256 colors, but it requires that your video card contain the Tseng Labs ET4000 chipset or the Trident 8900 chipset (also referred to as the Trident Impact Series III). So, first determine whether your video adapter is based on one of these chipsets, either by reading the documentation or by calling the manufacturer.

The next step is to reconfigure Pizazz Plus by running the Install program. If you access the installation program directly from the Pizazz Plus subdirectory on your hard disk (rather than from the original program disks) you can change the hardware configuration without going through a full-blown reinstallation. In either case, when you're asked to pick a video card, don't choose your video card by name; choose the appropriate chipset instead—you'll find both the Tseng Labs and Trident chipsets listed.

An even easier solution involves using Fractint's internal file functions. After you've generated a fractal image—while you're still viewing the fractal—simply press the s key. Fractint will save the image as a .GIF file, assigning a name and number automatically. For example, the first file you save will be named FRACT001.GIF.

The .GIF (pronounced jif) file format was created and continues to be maintained by CompuServe. Its primary purpose is to facilitate the transfer of images via modem by providing a highly compressed file format (using LZW compression) and cross-platform compatibility (.GIF files can be displayed on PCs, Macs, Amigas, Decs, and Suns).

Pizazz Plus 3.0 is able to read and write .GIF files, which means you can use it to print the .GIF file directly or to convert the file to any other standard raster file format, including .BMP, TIFF, or .PCX. These conversion routines are particularly useful if you want to use the fractal image in other applications programs, like Ami Pro 3.0. While Ami Pro doesn't

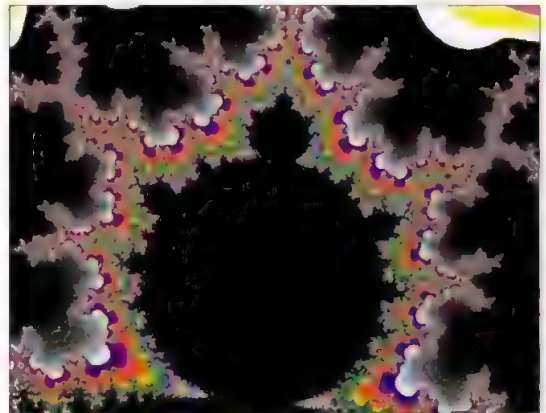


Figure 8: Fractint, a freeware program, can create complex images based upon fractal algorithms. Here you see a close-up view of the Mandelbrot Set.

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T6600

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- ▲ 486DX2/66 processor
- ▲ 8MB RAM, expandable to 40MB
- ▲ 10.4" active matrix color display
- ▲ 16mm PCMCIA slot
- ▲ 2 full length 16-bit ISA slots
- ▲ Detachable 101 key keyboard
- ▲ 2 built-in stereo speakers
- ▲ Microsoft Sound System
- ▲ MS-DOS 6.0, Windows 3.1, Asymetrix COMPEL and MediaBlitz!

Model	Description	Price
T6600C	Base model	\$6799*
T6600C/CD	Base model + Toshiba 5.25 200MS CD-ROM drive	\$7329
T6600C/CDV	Base model + CD-ROM drive + Mambo DVI board	\$8389

*Lease for 249.52/mo.



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Dual Scan Color Technology

Older generation passive displays have a 1/480 duty ratio which means that power is driven all the way from the top of the screen to the bottom of the screen. The T1900C's new dual scan color display has a 1/240 duty ratio. Imagine the screen split in two horizontally and now power is driven from the top and bottom of the screen. Since the T1900C receives power at twice the rate of older passive displays, the T1900C is brighter and faster.

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COMPAQ

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ProLinea...Solid Performance at Affordable Prices

- ▲ 486SX25, 486DX33, or 486DX2/66
- ▲ 120MB, 240MB, or 340MB
- ▲ 4MB RAM, expandable to 32MB
- ▲ 1024x768 Local Bus Graphics
- ▲ 3.5" floppy disk drive
- ▲ 3 ISA slots, 3 drive bays
- ▲ MS-DOS, Windows 3.1, mouse

Bundles include All standard features plus:

- ▲ 5.25" floppy drive
- ▲ PFS:Window Works
- ▲ Prodigy, 24/96 S/R fax modem

Call for Prices

ProLinea CDS... Computing Like You've Never Seen or Heard!

All standard features plus:

- ▲ 120MB hard drive
 - ▲ 375MS CD-ROM drive
 - ▲ MediaVision Pro AudioSpectrum 16 sound card
 - ▲ External speakers
 - ▲ 24/96 S/R fax modem
 - ▲ MS-DOS, Windows 3.1.
- PFS:Windows Works

Plus these popular CD-titles:

- ▲ Compton's Interactive Encyclopedia
- ▲ MICROGRAFX Graphics Works
- ▲ Mayo Clinic Family Health Book
- ▲ Where in the World is Carmen Sandiego?



DeskProM

Incomparable Upgradability

DeskPro 66M

- ▲ 486DX2/66 processor
- ▲ 8MB RAM, expandable to 64MB
- ▲ QVision Graphics controller, Business Audio
- ▲ 4 EISA 32-bit expansion slots
- ▲ Four drive bays
- ▲ 3.5" floppy disk drive
- ▲ 510MB hard drive
- ▲ MS-DOS, Windows 3.1, mouse



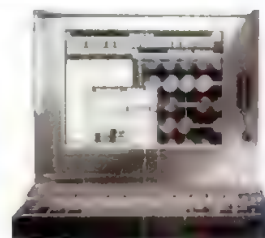
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Uncompromised, Full-featured Performance

LTE Lite 4/25, 4/25E

- ▲ 25MHz 486SL processor
- ▲ 4MB RAM, expandable to 20MB
- ▲ 120MB & 209MB.
- ▲ 9.5" mono display & UltraView active matrix display
- ▲ Built-in EasyPoint trackball
- ▲ Auxiliary battery
- ▲ Optional desktop expansion base



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Prices

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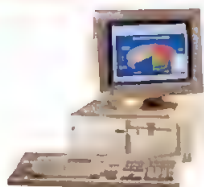
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AST, Compaq, Canon, Leading Edge, NEC



LEADING EDGE

WinPro 486 E

- 4MB RAM expandable to 32MB
- 8KB cache expandable to 256KB
- Windows Accelerator
- MS-DOS, Windows 3.1, MS Works
- MS-Productivity, Quick

Processor	Hard Drive	Price
486SX/25	120MB	\$979*
486SX/33	170MB	\$1099
486DX/33	170MB	\$1239
486DX/33	260MB	\$1349
486DX2/50	260MB	\$1499
486DX2/66	260MB	\$1599

Color VGA monitors start at \$229.99
Lease for \$50/mo.

\$979



NEC

Ready Desktops

- 4MB RAM, expandable to 64MB
- 3.5" floppy drive
- 9600/4800 fax 2400 data modem*
- MS-DOS 6.0, Windows 3.1, PFS-Window Works, America On Line, CompuServe

Processor	Hard drive	Price
486SX/25*	120MB	\$999*
486SX/33	210MB	\$1249
486DX2/66	250MB	\$1739

*486SX/25 does not include modem
NEC SVGA color monitor \$319.99
Lease for \$50/mo.

\$999



COMPAQ

ProLinea Desktops

- 4MB RAM expandable to 32MB
- 3.5" floppy drive
- Local Bus graphics
- MS-DOS 6.0, Windows 3.1, Mouse

Model	Hard drive	Price
486SX/25	120MB	\$999*
486SX/25	240MB	\$1089
486DX/33	120MB	\$1389
486DX/33	240MB	\$1469
486DX/33	440MB	\$1829

Bundles also available
COMPAQ SVGA color monitor \$349.99
Lease for \$50/mo.

\$999



Bravo Desktops

- 4MB expandable to 64MB
- 120MB or 210MB hard drive
- Local bus video 1024x768
- OverDrive and P24T upgradable

Model	123/W	213/W	Price
486SX	120MB		\$1029*
486SX	120MB		\$1299
486SX		210MB	\$1539
486DX		210MB	\$2099

Color SVGA monitors start at \$379.99

Lease for \$50/mo.

\$1029



Bravo LP

- "Green" PC
- 486 processor
- Accelerated local bus graphics
- Local Motion video capability
- Pentium/Overdrive upgradable
- MS-DOS 6.0, Windows 3.1, Mouse

Model	RAM	Hard drive	Price
4/25i	4MB	170MB	\$1179*
4/33	6MB	170MB	\$1449
4/33	8MB	340MB	\$1899
4/66d	8MB	340MB	\$2449

Lease for \$50/mo.

\$1179



Bravo MT MiniTower

- 4/8MB RAM expandable to 64MB
- 170MB or 340MB hard drive
- EPA Energy Star certified
- 32-bit accelerated local bus
- 6 16-bit ISA slots
- MS-DOS 6.0, Windows 3.1

Model	RAM	Hard drive	Price
4/33 173W	4MB	170MB	\$1539*
4/33 343W	8MB	340MB	\$1999
4/66d 173W	16MB	340MB	\$2999
4/66d 343W	8MB	340MB	\$2589

Lease for \$56.48/mo.

\$1539



Premia Desktops

- 8MB RAM expandable to 128MB
- 5 EISA slots, 5 drive bays
- 1.44MB 3.5" floppy drive
- Local bus, 1280x1024 resolution
- MS-DOS 5.0, Windows 3.1, MS mouse

Processor	Drive	Model	Price
4/33i	170MB	173W	\$1899*
4/33i	340MB	343W	\$2279
4/66d	170MB	173W	\$2509

AST SVGA color monitor \$379.99
Lease for \$69.69/mo.

\$1899



COMPAQ

DESKPRO/M

- 4 32bit EISA expansion slots
- Intelligent modularity
- QVision graphics controller
- MS-DOS, Windows 3.1, mouse

Processor	Hard drive	RAM	Price
486DX33	240MB	4MB	\$2659*
486DX33	340MB	4MB	\$3069
486DX2/66	516MB	8MB	\$3739

Compaq SVGA color monitor \$349.99

Lease for 97.58/mo.

\$2659

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Norton Desktop for Windows	\$79.99*
Norton pcANYWHERE	\$89.99*
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LapLink V	\$69.99*

*When purchased with a system

SOFTWARE
On **SYSTEMS**

Texas Instruments, Toshiba, Zenith Data Systems



TEXAS INSTRUMENTS

TravelMate 4000 Color

- 486 processor
- 640x480 VGA display 256 colors
- Local bus video**
- MS-BallPoint/Quickport connector
- MS-DOS, Windows 3.1

Processor	RAM	Display	Price
486SX/25	4MB	Enhanced color	\$2199*
486DX2/40	8MB	Passive	\$3299
486DX2/50	4MB	Active	\$3899

**except DX2/40

Lease for \$80.70/mo.

\$2199*



COMPAQ

Contura

- 486SL/25 processor
- 4MB RAM
- Trackball, MS-DOS, Windows
- 3-year warranty

Display	Hard drive	Price
Monochrome	209MB	\$2199*
Dual scan color	120MB	\$2699
Dual scan color	209MB	\$2879

Lease for \$80.70/mo.

\$2199*



ZENITH DATA SYSTEMS

A Bull Company
Z-NOTE+

- 486SL/25 processor
- 1MB RAM, expandable to 28MB
- 200MB hard drive
- NOTEPOINT™ pointing device
- Built-in Ethernet
- MS-DOS 6.0, Windows 3.1
- MS-Windows for Workgroups

Screen	Price
Monochrome	\$2469*
Dual scan color	\$3129
Active matrix color	\$3699

Lease for \$90.61/mo.

\$2469*



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PCM-11/93B



Canon

NoteJet

- 25 MHz 486SLC
- 4MB RAM, expandable to 12MB
- 9.5" backlit mono display
- 2 PCMCIA Type II slots
- Bubblejet printer built-in
- 116 cps, 360x360dpi
- Auto sheet feeder built-in

135MB hard drive

\$2539*

180MB hard drive

\$2699

Lease for \$93.18/mo.

\$2539*



NEC

UltraLite Versa

- 4MB RAM, expandable to 20MB
- 2 PCMCIA slots
- Local bus graphics
- MS-DOS 6.0, Windows 3.1, trackball

Processor	Screen	Hard drive	Price
486SL 25	Monochrome	120MB	\$2149*
486SL 25	Monochrome	180MB	\$2959
486SL 25	Active color	120MB	\$3799
486SL 25	Active color	180MB	\$4099
486SL 33	Monochrome	180MB	\$3229
486SL 33	Monochrome	250MB	\$3439
486SL 33	Active color	180MB	\$4299
486SL 33	Active color	250MB	\$4499

Lease for \$100.88/mo.

\$2749*



ZENITH DATA SYSTEMS

A Bull Company
Z-NOTE+

- 486SL/33 processor
- 4MB RAM, expandable to 28MB
- 200MB hard drive
- NOTEPOINT™ pointing device
- Built-in Ethernet
- MS-DOS 6.0, Windows 3.1
- MS-Windows for Workgroups

Screen	Price
Monochrome	\$2749*
Dual scan color	\$3499
Active matrix color	\$4199

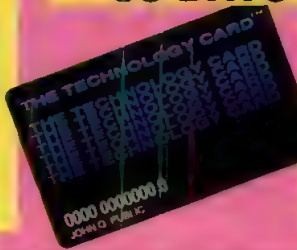
Lease for \$100.88/mo.

\$2749*



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support .GIF images, it can easily import .BMP, TIFF, or .PCX images.

For readers who may not be familiar with Fractint, I've produced a sample fractal image using the famous Mandelbrot Set algorithm (see the screen shot in Figure 6). Fractint is the creation of the Stone Soup Group, a collection of graphics programmers and fractal enthusiasts. Version 18.2 of Fractint, which by the way is freeware, can be downloaded from CompuServe by typing Go Graph-Dev and accessing Library 4.

One final note: I reread the review of Pizzaz Plus that encouraged you to buy the product in the first place, and your confusion is understandable. The features table item you cited actually refers to a special—separate—utility (bundled with Pizzaz Plus 3.0) that can capture any Windows screen. We should have noted that, like all DOS programs, Pizzaz Plus itself is limited to the resolutions of the video drivers it supplies.—*Luisa Simone*

PRINTING A VERY LARGE SPREADSHEET

❗ Can you tell me how to import a Lotus 1-2-3 2.x worksheet into an AutoCAD drawing? I'd like to print a large spreadsheet on plotter-size paper—a feat apparently not possible in Lotus 1-2-3, Microsoft Excel, or Borland's Quattro Pro since plotters can't be installed as the printer.

*Steve Onysko
Stateline, Nevada*

► **PC MAGAZINE:** The most direct route between Lotus 1-2-3 2.x and AutoCAD requires that you export your worksheet as a printer file (the commands are \Print\ File). This will create an ASCII file where extra spaces separate the columns from each other. You then can import the ASCII file into AutoCAD using an AutoLisp routine, called ASCTEXT.LSP, that's supplied with the program.

Once you've imported the file into AutoCAD, you'll find that there's only one way to keep the columns aligned: You must format the text with a monospace font. Unlike proportional fonts where each letter has a unique width, monospace fonts use the same amount of

space for each letter or punctuation mark. This is the only way to guarantee that the horizontal spacing (and thus column alignment) remains consistent for each item in your spreadsheet. Unfortunately, your design choices will be severely limited because AutoCAD offers only one monospace font—Monotxt9.

You can install a plotter as the current printer, however, if your spreadsheet program runs under Windows. Hewlett-Packard's plotter division now routinely ships a Windows driver with the HP DraftMaster Plus, HP DraftPro Plus, and HP DesignJet plotters. Contact the manufacturer of your specific plotter in order to obtain a Windows driver or, if your plotter emulates an HP device (which is quite likely), you can call the Hewlett-Packard Customer Information Center at 800-752-0900.—*Luisa Simone*

Networking

CONNECTING LAPTOPS TO THE LAN

❗ When our salespeople come into the office they need to connect to the network. We would like, however, to give them laptops as replacements for their desktop PCs. What's the best way we can continue to provide them with LAN connections although they'll no longer have permanent nodes?

*Douglas DeWitt
San Antonio, Texas*

► **PC MAGAZINE:** Although you can get LAN cards made to fit PCMCIA slots, I strongly recommend external network adapters that plug into parallel ports—despite the evolution in capability and speed that the parallel port is undergoing. Why? Incompatibilities still exist between PCMCIA LAN adapters and different makes of PCMCIA-equipped laptops. Also, the parallel port lends itself better to daily connection and disconnection.

If you do choose an external device, your plans should take into account the enhancements to the parallel port that may soon occur. A signaling system that was meant to speed parallel port through-

put—the Enhanced Parallel Port (EPP)—gained only limited support, primarily from Xircom and Zenith Data Systems. Now, however, the EPP has been rolled into a more comprehensive standard—IEEE 1284—that should be formally released by the end of 1993. IEEE 1284 defines both the EPP and another type of parallel port supported by HP and Microsoft called the Extended Capabilities Port (ECP). The standard also describes the electrical connectors and cables that can extend parallel port signals over distances up to 30 feet and at speeds up to 5 megabytes per second.

EPP provides fine control over the data for interactive communications through devices such as LAN adapters, CD-ROMs or tape drives. ECP moves data in bigger blocks and is especially useful as a high-speed interface to printers and scanners. Both are more useful than the simple parallel port available on most PCs. At the very least IEEE 1284 will offer an interesting alternative to PCMCIA and SCSI. Look for manufacturers to advertise the IEEE 1284-compatible parallel ports of an emerging group of PCs and peripherals.

—*Frank J. Derfler, Jr.*

FINDING FILES

❗ We generate one or two dozen letters a week from three PCs on our small network. To find any particular correspondence, though, our typists must often open 12 or more documents on the server. How can we control these files so we can find what we wrote?

*Tim Hudson
Phoenix, Arizona*

► **PC MAGAZINE:** Powerful document management programs such as PC DOCS make it easy to retrieve a specific document and all the related ones, but it doesn't sound like you have the volume to support a big installation. My own situation sounds closer to yours, in fact.

My server holds about a thousand articles, chapters, and columns I've written. I use a product—Sherlock—that allows me to create filenames with as many as 254 characters, which provides plenty of space to identify the source, destination, and nature of a document.

SINCE OUR UPS COSTS LESS, LET'S FORGET ABOUT PRICE FOR A MINUTE...MAN

**BECAUSE WHEN THE
POWER DIPS, ITS
NOT WHAT YOU PAID
FOR YOUR UPS
THAT'S IMPORTANT,
ITS WHAT IT DOES**

**SO LET'S TALK ABOUT
FEATURES...**

The MINUTEMAN ALLIANCE A750 keeps your network safe from brownouts, the most common power problem. Our line-interactive technology continuously monitors and provides an automatic boost whenever power dips. This important feature prevents frequent battery usage, saving the battery for more severe power problems.

Other important features that make the MINUTEMAN A750 stand out are a 750 VA

rating, extensive status indicators and a Test button so that you can confirm that the UPS is doing its job. A Site Wiring Fault Indicator is included to let you know if there is a problem with grounding or other on-site electrical wiring problems that could be catastrophic.

The Alliance A750 is compatible with MINUTEMAN's LanMaster unattended shutdown software for all operating systems to further protect your network, even when you're not there.

If all UPSs were priced the same, the choice would be easy based only on features. But when you compare prices, the choice becomes even more obvious.

We don't believe you'll pay 38% more for a product that gives you less. Call our POWER HOTLINE now and find out how to get more UPS for less.

MAKE THE COMPARISON YOURSELF

Model	Minuteman A750	Trip Lite Omni 750	Best SPS650B
PRICE	\$429	\$699	\$449
VA Rating	750	750	650
Line-Interactive	YES	YES	NO
Waveform Output	Simulated Sinewave	Square-Wave	Simulated Sinewave
LED Status Indicators	YES 4-LED's	YES 2-LED's	YES 1-LED
Site Wiring Fault Indicator	YES	NO	NO
Test Button	YES	NO	NO

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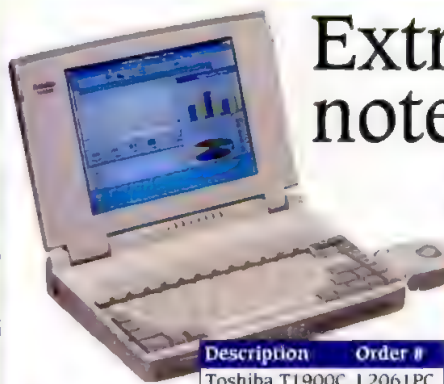
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Description	Order #
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Extraordinary notebook power.

Sturdy Dupont cordura nylon carry case for
portables comes with Lotus Organizer, Lap-
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A \$500
value **FREE**
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Description	Order #
NEC UltraLite Versa Color	L2060PC

The affordable Toshiba T1900C gives you
powerful 486SXA processing capability.

\$2449 High-speed graphics,
Windows processing,
plus a PCMCIA slot.

For presentations on the road, it's Toshiba's
color T1900C with its 4 MB RAM, 120 MB
hard drive, STN active matrix display, more.



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Portrait 15/Plus
Pivoting Monitor.

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vertical Windows
document.

Pivot from landscape to portrait to read an
entire 8 1/2 x 11" page without scrolling, pivot
back for spreadsheets. Monitor breakthrough!

Description	Order #
Portrait Display 15/PLUS	L2435PL

**NEC UltraLite Versa Color is the
world's most versatile notebook.**

\$3839

Breaking-the-limits portable has the
power, ports and expandability.

NEC UltraLite Versa leads the pack
with its i486SL 25 MHz processor,
120 MB hard drive, expandable
4 MB RAM, 2 PCMCIA slots, TFT-
active-matrix display, and optional
docking station and second battery.



**Conner 250 MB Tape
Backup Drive is quality plus.**

\$169 Description Order #
Tape*Stor L2591PL

Reliability's built in.

QIC-80 Conner Tape*Stor drive
comes with **FREE** backup software
for DOS, Windows, OS/2, NetWare,
etc. Plus **FREE** tape included.



Revolutionary Improv: \$99!

Description	Order #
Lotus Improv 2.0	L230213

Includes **FREE** upgrade to 2.1*!
Lotus Improv 2.0 gives you self-
documenting spreadsheets and
quick multiple views of data. You
also get a free* upgrade to 2.1.

*\$10 shipping and handling fee.

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Canon BJ-10EX: big-machine performance, small footprint.

\$259

Description	Order #
Canon BJ-10EX	L2552PL

Takes up no more desk space than a sheet of paper.

Canon's BJ-10EX weighs 4 lbs., yet prints with a sharp 360 dpi resolution. Windows, DOS compatible. **FREE!** Automatic sheetfeeder—a \$90 value—while supplies last.

Get a dot matrix printer with PostScript capability.

\$279

Description	Order #
3 1/2" media	L2592PL
5 1/4" media	L2596PL

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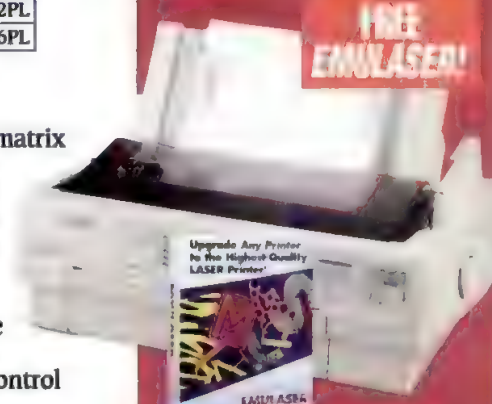
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Contact 2010 Software, the makers of Sherlock, at 800-952-2314 or 212-887-9555.—*Frank J. Derfler, Jr.*

Languages

DELAYS IN PASCAL WINDOWS PROGRAMS

TIP I am currently using Turbo Pascal for Windows 1.5. Prior to this I did all my programming in the DOS versions of Turbo Pascal. One function I often found myself using was the built-in procedure `DELAY(x)`, where x equals the time you want to delay program execution in milliseconds. When I made the move to TPW, I was disappointed to find that this procedure was no longer available. To overcome this obstacle I came up with a Windows version of a delay procedure, shown in Figure 7.

This procedure uses the Windows API function `GetTickCount`, which returns the number of milliseconds that have elapsed since Windows was started. The `Delay` procedure simply reads a starting value from `GetTickCount` and stores it in the variable `Start`. It then repeatedly compares this original value with the current value returned by `GetTickCount`. When the difference is greater than the specified time T , the procedure exits. This will not be an exact delay to the millisecond, but it is a usable approximation.

*Kevin Cordle
Rowlett, Texas*

DELAYTST.PAS

Complete Listing

```
PROGRAM DelayTest;
USES WinCrt, WinTypes, WinProcs;

PROCEDURE Delay(T : LongInt);
  (T is time in ms)
  VAR Start : LongInt;
  BEGIN
    Start := GetTickCount;
    WHILE GetTickCount - Start <= T DO
      END;

PROCEDURE Gasp;
  VAR Msg : TMsg;
  BEGIN
    WHILE PeekMessage(Msg, 0, 0, 0, pm_Remove) DO
      IF Msg.Message = WM_Quit THEN Halt
      ELSE
        BEGIN
          TranslateMessage(Msg);
          DispatchMessage(Msg);
        END;
      END;

PROCEDURE DelayOk(T : LongInt);
  (T is time in ms)
  VAR Start : LongInt;
  BEGIN
    Start := GetTickCount;
    WHILE GetTickCount - Start <= T DO Gasp;
  END;

BEGIN
  WriteLn('When you press Enter, a ten-second delay will');
  WriteLn('begin. Try to switch to another window, or ');
  WriteLn('move THIS window. You can\'t!');
  ReadLn;
  WriteLn('Delay beginning...');
  Delay(10000);
  WriteLn;
  WriteLn('When you press Enter again, another ten-second');
  WriteLn('delay will begin, but this one includes code');
  WriteLn('to let Windows continue processing messages. ');
  WriteLn('Try to move this window, or switch to another');
  WriteLn('window - this time you CAN. ');
  ReadLn;
  WriteLn('Delay beginning...');
  DelayOk(10000);
  WriteLn('Demonstration complete. ');
END.
```



Figure 7: This program illustrates two different ways to produce a timed delay in a Windows program. The first is unacceptable because it halts all message processing on the system.

► **PC MAGAZINE:** Borland provides a unit called `WinCrt` to make it easy for programmers who are familiar with the DOS-based Pascal product to move to the Windows version. `WinCrt` creates a window that emulates the standard text-output screen, and it includes equivalents for most of the functions contained in the DOS product's `Crt` unit. However, Borland did *not* include an equivalent for the `Delay` procedure—and with good reason. This procedure repeats a loop of doing nothing code for a number of repetitions calculated to produce the desired period of delay. In a nonpreemptive multitasking environment such as Windows, such a loop brings the system to a screeching halt!

The *standard* way to create a delay in a Windows program is to set a timer for the desired length of time and respond to the resulting `WM_TIMER` message.

However, simple programs written using the `WinCrt` unit can't do that, because they don't have access to their own window handle. The alternative is a looping delay function that includes code to let Windows process messages for other programs. Run the program in Figure 7 to see the difference between the two `Delay` routines. While the first one runs, *nothing* else works. You can't switch windows, can't move the program's window—even the clock stops updating its display. The second function, `DelayOk`, calls the procedure `Gasp` each time through the loop, and this allows Windows to continue processing other tasks. If you need a `Delay` function in TPW, use the second version!

You can download `DELAYTST` from PC MagNet's Programming forum archived as `DELAYT.ZIP`.

—*Neil J. Rubenking*

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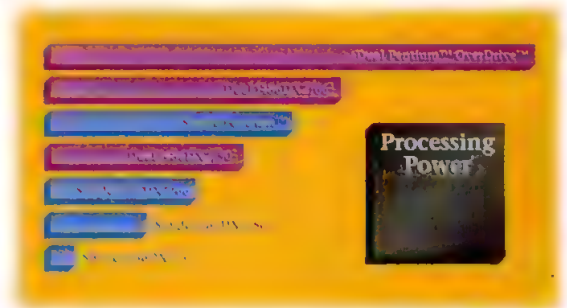
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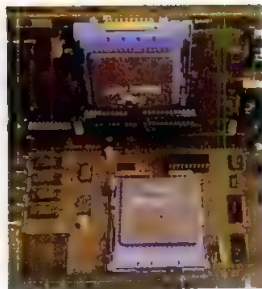
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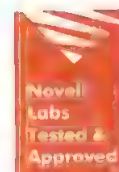
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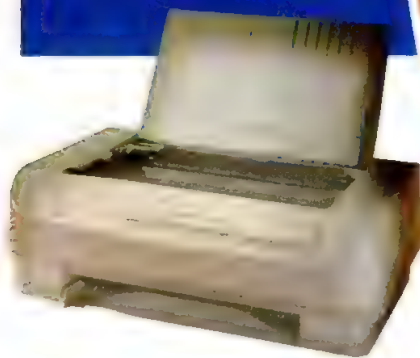
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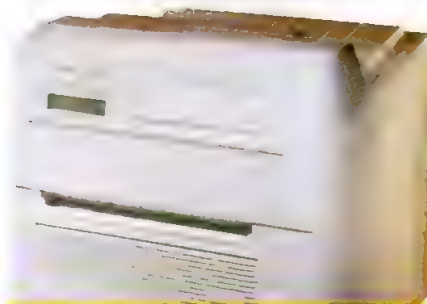
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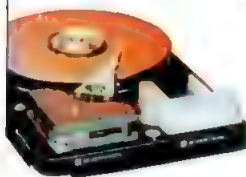
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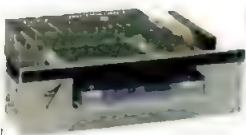
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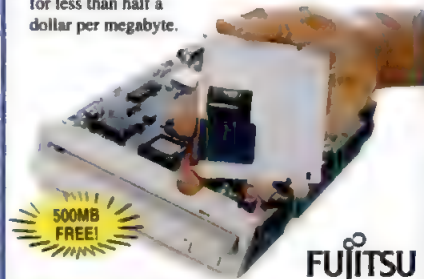
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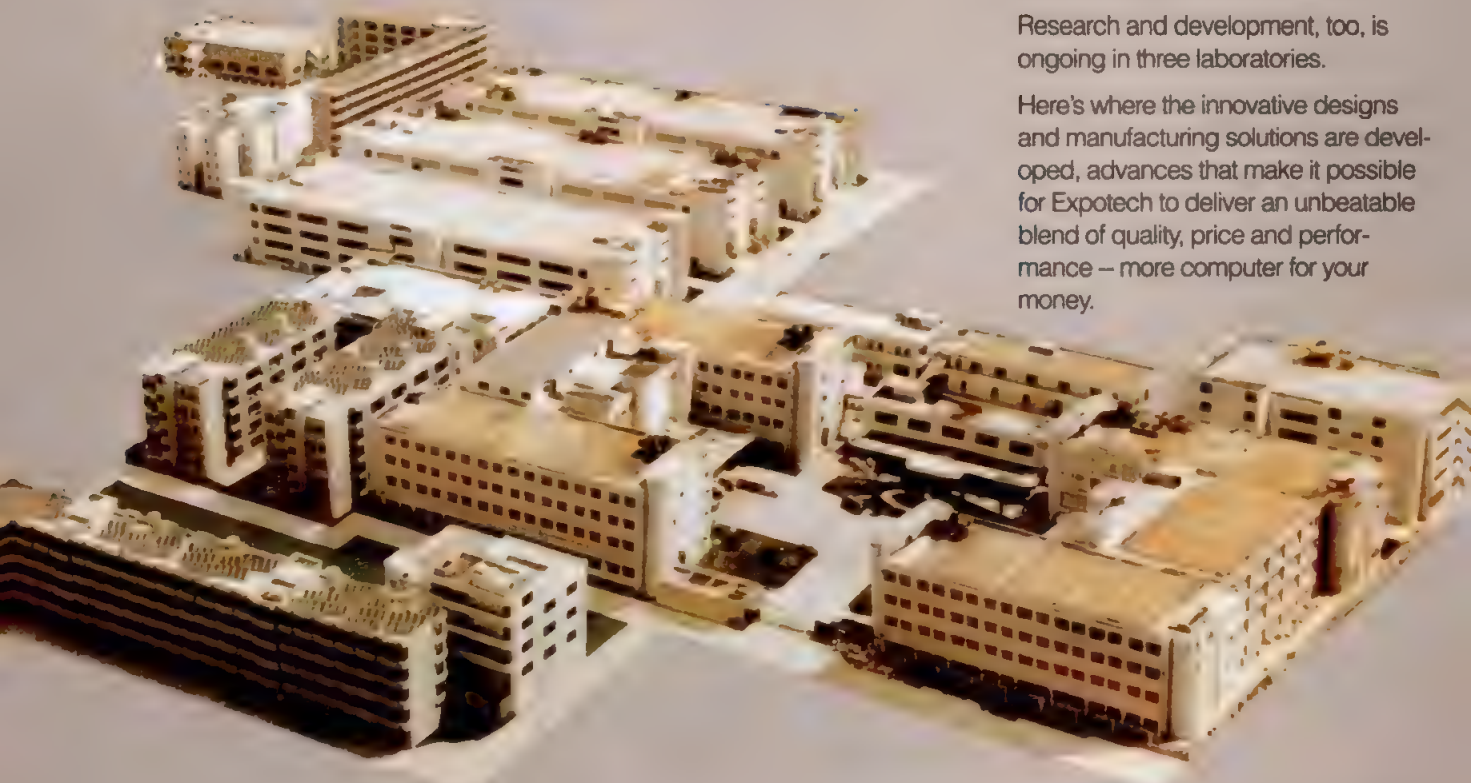
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SYSTEM FEATURE	expo tech	DELL	GATEWAY	ZEOS	compag prolinea	IBM Value Point
ANTI VIRUS SOFTWARE	YES					
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- Multi I/O (2 Serial, 1 Parallel, 1 Game Port)
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- 32-Bit VESA Local Bus IDE Card
- 245 Mb IDE Hard Drive
- 1.44 Mb 3.5" Floppy Drive
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- ✓ Diamond Stealth 24 VESA Local Bus SVGA Video Card
- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
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- 1.44 Mb 3.5" Floppy Drive
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- ✓ 3 Disk CD-ROM Software Library
- ✓ 16-Bit High-Performance Sound Card
- ✓ Digital-Quality, Compact Speakers
- ✓ 15" SVGA .28 Non-Interlaced Multi-Scan Color Monitor
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- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
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- ✓ 340 Mb IDE Hard Drive
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- 1.2 Mb 5.25" Floppy Drive
- ✓ 17" SVGA .28 Non-Interlaced Digital Color Monitor
- ✓ Diamond Stealth 24 VESA Local Bus SVGA Video Card
- 1 Parallel, 2 Serial & 1 Game Port
- 101-Key Enhanced Keyboard
- High-Resolution, 3-Button Mouse
- 7-Bay Full-Tower Case
- FREE Microsoft DOS 6.0 Installed
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486SX/DX Notebooks are available with a 10" active-matrix

color, dual-scan color or monochrome screen and up to a 340 Mb hard drive to capture your work in style. For maximum versatility they also come with a PCMCIA Type III slot which accepts two Type II cards or one Type III card. Swap modems, LAN, storage, or flash cards without powering down.

Order your 486SX/DX Notebook today and discover how Elite Notebooks raise computing to a fine art.



120 Mb	486SX-25	486DX-33	486DX2-50
Monochrome	005501 \$1599	005516 \$1849	005531 \$1999
Dual-Scan Color	005506 \$2349	005521 \$2599	005536 \$2749
Active-Matrix Color	005511 \$3199	005526 \$3399	005541 \$3599

For an 80 Mb hard drive subtract \$40. For a 200 Mb hard drive add \$100.

For a 340 Mb hard drive add \$280.

Elements:

Processor:

Intel 486SX-25, 486DX-33 or 486DX-50 SL-Enhanced upgradeable processor

RAM:

4 Mb, expands to 20 Mb

Hard Drive:

80 Mb, 120 Mb, 200 Mb or 340 Mb

Screen:

10", 640 x 480 VGA resolution
Backlit display
Color - 256 colors
Monochrome - 64 gray shades

Battery Life*:

Active-Matrix Color - 3 hours
Dual-Scan Color - 4 hours
Monochrome - 6 hours

Weight:

Color - 6.9 lbs.

Monochrome - 6.4 lbs.

512K DRAM plus 64K

VRAM for turbo bus accelerated video technology

Simultaneous video on active-matrix and monochrome models

86 keys with 101-key emulation

Built-in trackball

Built-in 1.44 Mb, 3.5" floppy drive

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Type II slots

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FREE MS-DOS 6.0 installed

*Battery life measured with Power Management enabled. Actual battery life may vary.

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Elite 486SX-25 SubNote

Illustrate Your Points On This 10" Screen

You'd think a small 3.9 lb. SubNote would be hard to work on—but it's not. Elite's 486SX-25 SubNote delivers 640 x 480 VGA resolution on its 10" high-contrast screen so you can illustrate charts and graphs that are easy to read. And unlike other notebooks that leave your wrists hanging, the Elite SubNote offers a built-in trackball and extended palm rest to support wrists.



But, that's not all! The Elite SubNote receives rave reviews for its special Intel SL-Enhanced processor that conserves power and extends battery life up to five hours when combined with Advanced Power Management.

For extra power take advantage of the SubNote's PCMCIA Type II slot. It lets you insert credit-card sized PC cards for modems, flash memory, network adapters and more.

Get the picture? Now get the Elite 486SX-25 SubNote and get a whole new view of portable computing!

486SX-25 SubNote

Model	Item #	Price
80 Mb	005575	\$1499
120 Mb	005576	\$1549
200 Mb	005577	\$1639
340 Mb	005578	\$1799

Elements:

Processor:
Intel 486SX SL-Enhanced upgradeable processor

Processing Speed:
25 MHz

RAM:
4 Mb expands to 12 Mb

Hard Drive:
80 Mb, 120 Mb, 200 Mb or 340 Mb

Screen:
10", 640 x 480 VGA resolution

Backlit display
64 gray shades

Battery Life*:
5 hours

Weight:
3.9 lbs.

512K DRAM plus 64K VRAM
for turbo bus accelerated video technology

Simultaneous video
83 keys with 101-key emulation

Built-in trackball

External 1.44 Mb, 3.5" floppy drive

Advanced Power Management

Nickel metal hydride battery

One parallel and one serial port

External VGA and keyboard connectors

One PCMCIA Type II slot

FREE AC adapter and utilities disk

FREE MS-DOS 6.0 installed

Elite 486SLC-33 Color/Monochrome Notebook

486 Notebooks At Starving Artist Prices

Get more power for your money with Elite 486SLC-33 Notebooks. Available in color or monochrome, these notebooks come with fast 33 MHz Cyrix processors, internal cache memory, and up to 8 Mb of RAM.

For maximum system flexibility, you can add an additional RAM module, a V.42bis internal fax modem or an external docking station.

Both models provide non-glare VGA screens that eliminate distortion, flickering and eye strain so you can compute



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And if you get caught up in your creative endeavors, a quick glance at the LCD panel lets you know which drives are being accessed, when battery power is low, what function keys are enabled, whether external power is being used and if there is a modem ring.

Affordably priced Elite 486SLC-33 Color/Monochrome Notebooks are a real work of art. Order yours today!

486SLC-33 Notebooks

Color		
Model	Item #	Price
80 Mb	005461	\$1699
120 Mb	005466	\$1769
200 Mb	005471	\$1889
Monochrome		
Model	Item #	Price
80 Mb	005446	\$1209
120 Mb	005451	\$1279
200 Mb	005456	\$1399

Elements:

Processor:
Cyrix 486SLC-33

Processing Speed:
33 MHz

RAM:
2 Mb RAM, expands to 8 Mb

Hard Drive:
80 Mb, 120 Mb or 200 Mb

Floppy Drive:
Built-in 1.44 Mb 3.5"

Screen:
Color - 9", 256 colors
Monochrome - 10", 64 gray shades

Video RAM:
Color - 512K
Monochrome - 256K

Keyboard:
83 key with 101-key emulation
2-button thumball mouse

Weight:
Color - 5.7 lbs. with battery
Monochrome - 5.4 lbs. with battery

Battery Life*:
Color - 4 hours
Monochrome - 6 hours

640 x 480 resolution

Simultaneous video

Advanced Power Management

One parallel and one serial interface

External VGA monitor and keyboard connectors

FREE AC adapter carrying case and MS-DOS 6.0 installed

One year manufacturer's warranty



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GSX-240	003085	\$279

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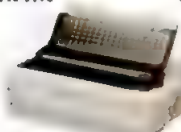
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AP-3250	003090	\$179
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DFX-8000	001182	\$2349
FX-870	002094	\$279
FX-1170	004099	\$369



LQ-570+
\$249
002099

LQ-870	001987	\$465
LQ-1070+	002105	\$389
LQ-1170	001988	\$635
LQ-2550	000074	\$939
LX-810	000645	\$175

INK JET PRINTERS

Stylus 300	003554	\$239
Stylus 800	003552	\$329

LASER PRINTERS

AL1000	002125	\$639
AL1500	002185	\$679
EPL-8000	001194	\$875

*Price with manufacturer's rebate. Valid through 12/31/93

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005908	\$449
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IBM Personal Printer 2390

005909	\$325
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IBM LaserPrinter 10	005902	\$1139
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Silentwriter 95fx	002847	\$1109
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KX-P1695	000018	\$369
KX-P2023	001658	\$199
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KX-P4440	001674	\$1249
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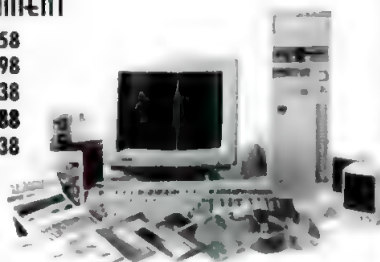
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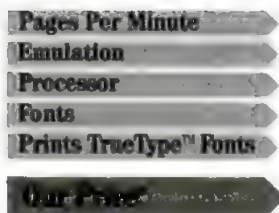
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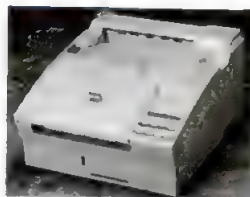
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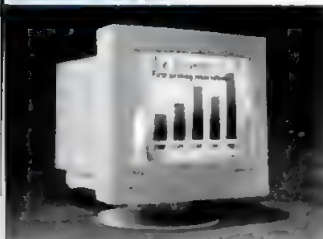
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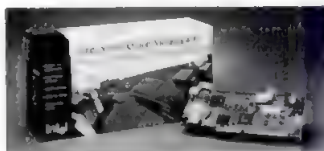
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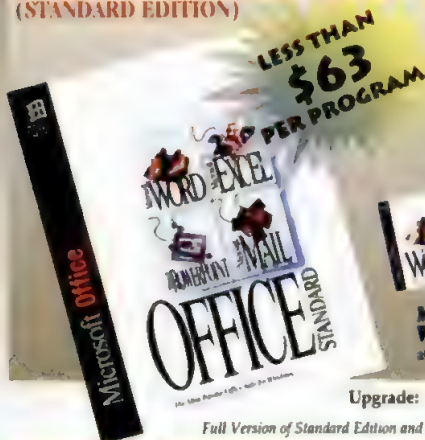
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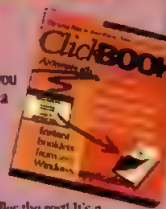
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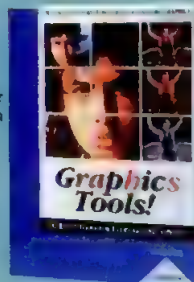
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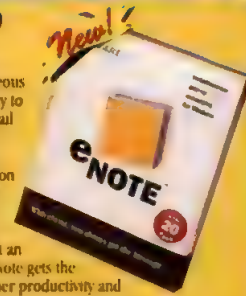


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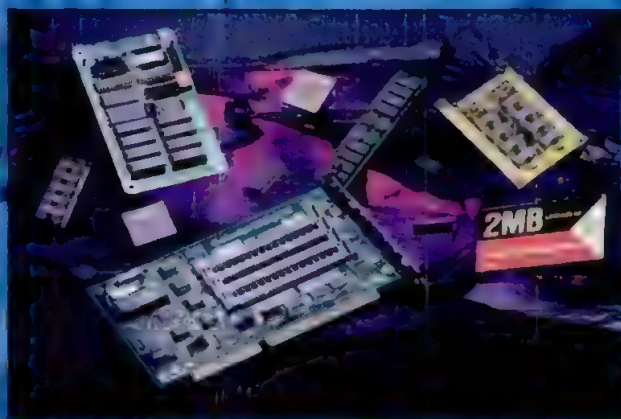
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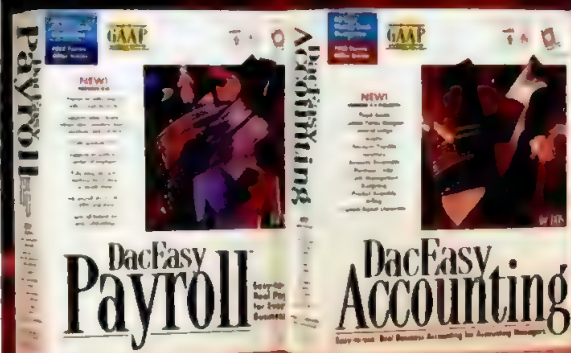
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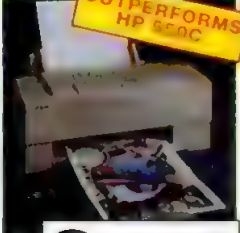


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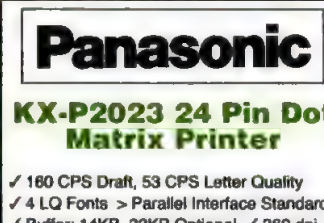
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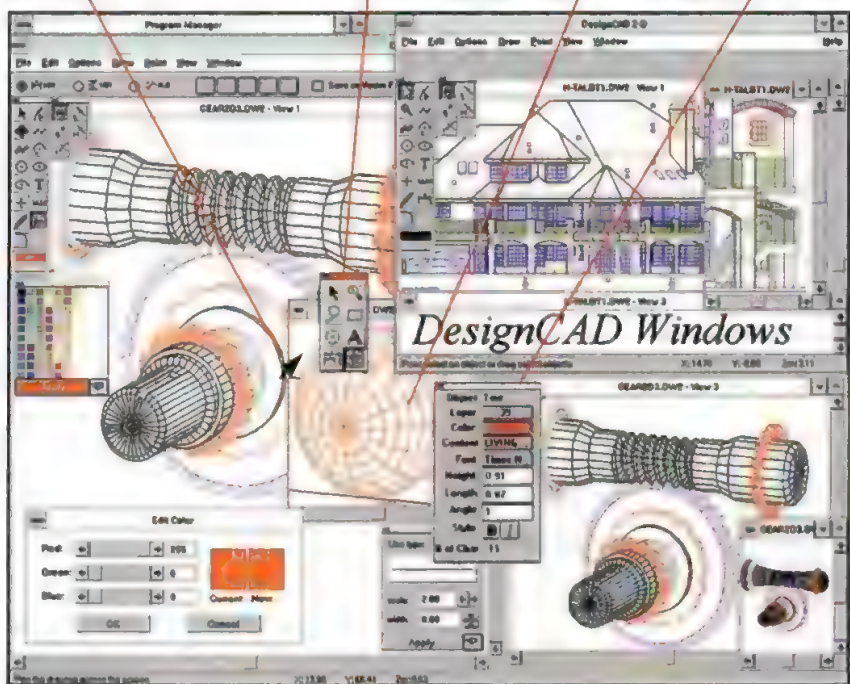
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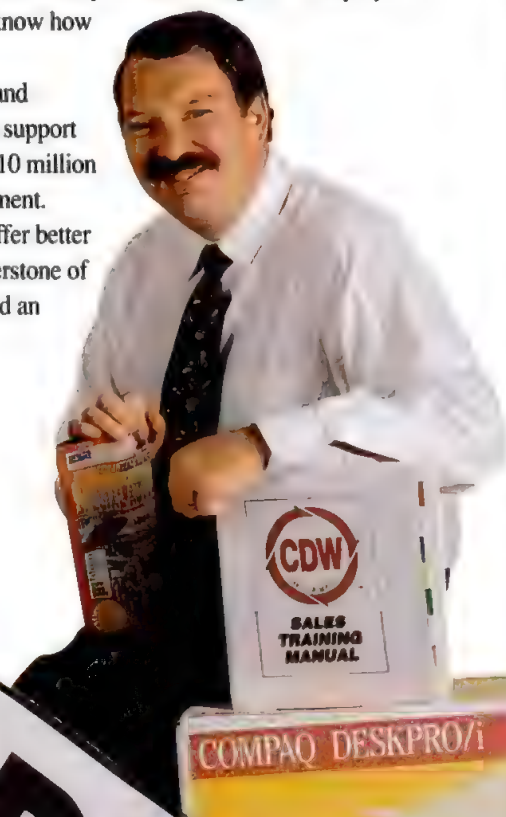
All the employees at the Computer Discount Warehouse are still in school. No, they're not teenagers anymore, but they're all enrolled in a program called CDW University—which they also call "Customer U."

"We believe that the only way to grow is to make the customer #1," says Michael Krasny, the company's CEO. "That's why we established an on-going, mandatory training program that focuses on customer service and product briefings. Our employees also have personal, hands-on experience of a lot of the products they sell—and they know how to treat the customer right."

The customer support program at CDW, a ten-year-old reseller of PC hardware and software, includes free technical support from 8 a.m. to 7:30 p.m. "We guarantee that support calls will be answered within three minutes," says Krasny. He also points out that a \$10 million product inventory makes it possible for the company to provide same-day order shipment.

Computer Discount Warehouse has turned their success into an opportunity to offer better customer service, and Krasny singles out his advertising in PC Magazine as the cornerstone of his success. "We've been in the PC Direct section since 1986, and we've never missed an issue. Our most loyal customers, the ones who appreciate service, come to us through PC Magazine. No matter how you look at it—closing rate, calls per ad dollar—PC Magazine is tops."

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Input/Output Devices/Barcoding	473	484
Mass Storage Devices	475	487
Midi	476	
Multi-Media	476	
Networking	477	
OS2		
Security		
Video		

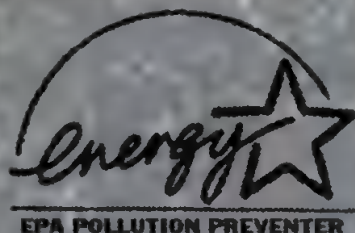
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	Premier	Classified
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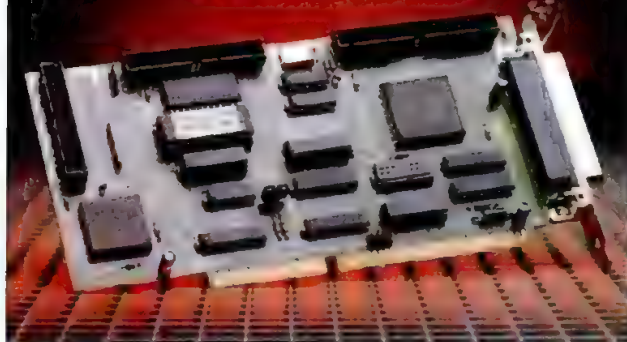
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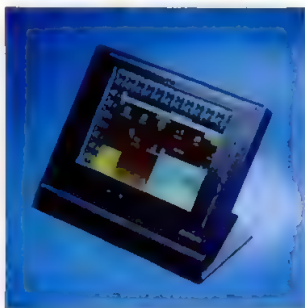
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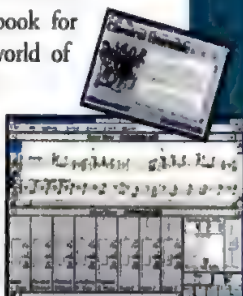
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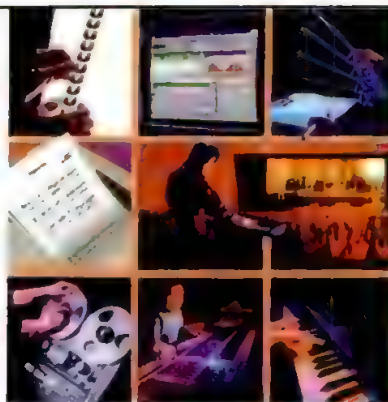
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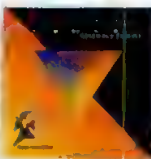
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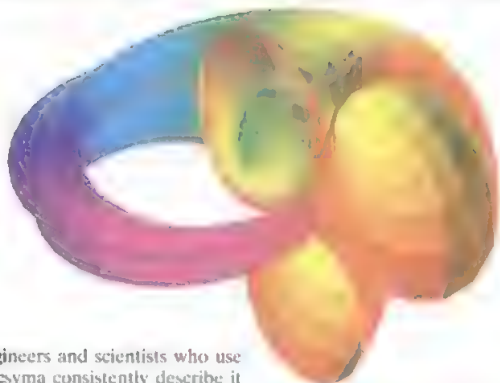
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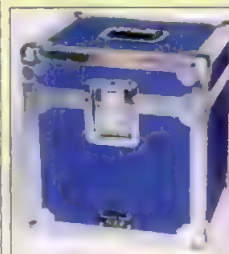
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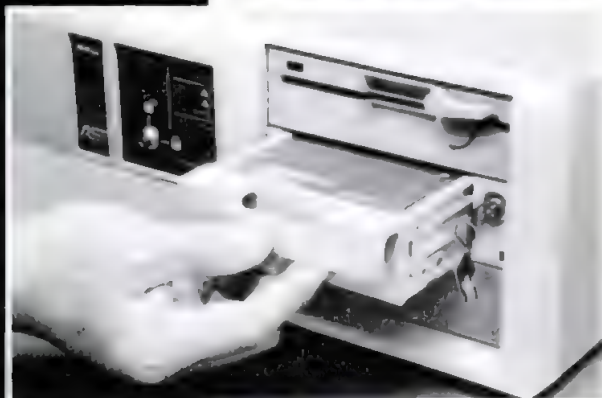
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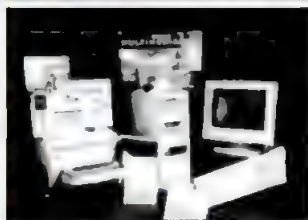
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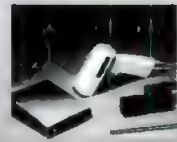
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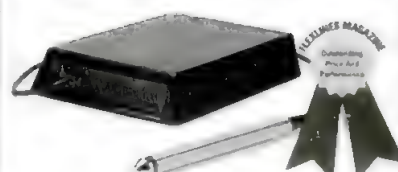
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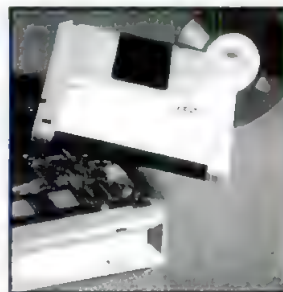
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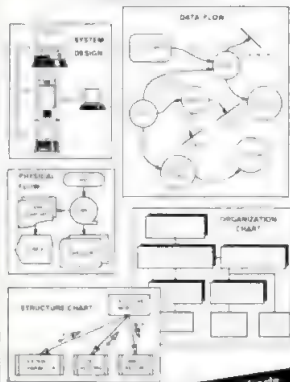
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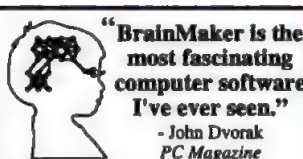
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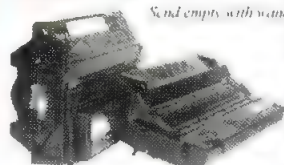
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4. Is your company a reseller?
01. ☐ Yes 02. ☐ No

5. For how many IBM PCs and compatibles do you specify brands of products:

01. ☐ 10 or less 03. ☐ 26-99
02. ☐ 11-25 04. ☐ 100 or more

6. Are there any PCs in your office?

01. ☐ Linked to mainframe
02. ☐ Linked to mini
03. ☐ Networked together
04. ☐ IBM or Compatible PCs
05. ☐ IBM or Compatible Mainframes
06. ☐ IBM or Compatible Minis
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09. ☐ Windows

8. Do you plan to buy any PC products?

01. ☐ Now 03. ☐ In 7 to 12 months
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9. Number of employees in your entire company:
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6. Are there any PCs in your office?

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03. ☐ Networked together

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04. ☐ Macintosh
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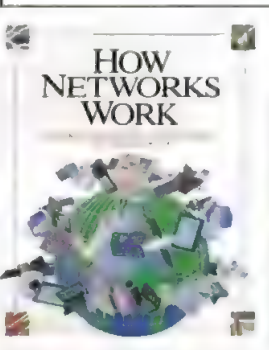
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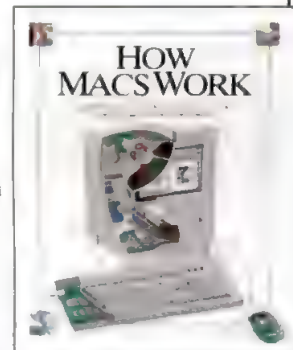
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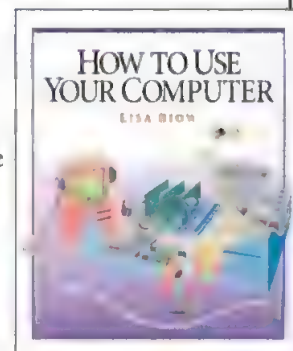
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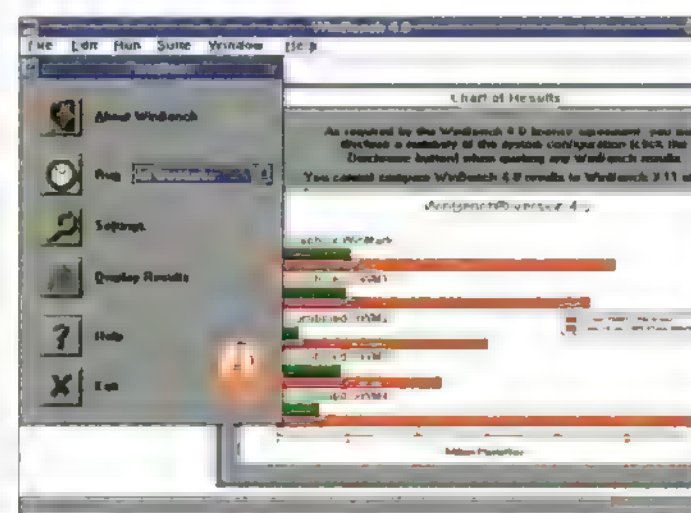
The PC Buyers' Guide

With computer technologies evolving at an ever-increasing pace, today's PC buyers are confronted with the monumental task of wading through a sea of computers. *PC Magazine* cuts through all the hype and hoopla to evaluate 89 separate lines of PCs—the most ever assembled in one place.

Video Boards

The demands of Microsoft Windows 3.1 and sophisticated graphical applications are driving users to seek more advanced video performance. Video cards are offering increasingly higher resolutions, color support, and fuller features at lower prices. In our largest video card roundup yet, we review 43 graphics accelerator boards that will redefine the mainstream. We test each of these boards, each of which has 2MB of memory, with our new benchmark tests. We also look at some of the first PCI-based accelerator boards.

Lab Notes



PC Magazine has always relied heavily on benchmark test measurements to compare the performance of one computer system against that of another. Coming up, we'll debut a new series of benchmark

tests that have been designed to measure all aspects of your computer system's performance. From synthetic measurements of disk speed to application-based benchmark tests that use popular programs to measure computer performance, we'll tell you all about *PC Magazine's* new series of benchmark standards.

Free Utility

Although Windows will let you multitask your favorite programs, you can't keep loading more and more programs indefinitely. Eventually, you'll fill up all of your system's memory or run out of Free System Resources (FSRs). Our next issue's free utility, MONTOR, tracks your system's memory, FSRs, and disk space, and warns you if any one of them gets too low. Drag-and-drop alarm settings make MONTOR's unique interface fun to use, too.

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462	HP DeskJet 1200C/PS	Hewlett-Packard Co.
428	HP DeskJet 310	Hewlett-Packard Co.
444	HP DeskJet 550C	Hewlett-Packard Co.
475	HP LaserJet 4L	Hewlett-Packard Co.
475	HP LaserJet 4M	Hewlett-Packard Co.
475	HP LaserJet 4ML	Hewlett-Packard Co.
475	HP LaserJet 4MP	Hewlett-Packard Co.
475	HP LaserJet 4P	Hewlett-Packard Co.
505	HP LaserJet 4Si	Hewlett-Packard Co.
505	HP LaserJet 4Si MX	Hewlett-Packard Co.
463	HP PaintJet XL300 PostScript	Hewlett-Packard Co.
453	IBM 2380 Plus	Lexmark International Inc.
424	IBM 4037 SE	Lexmark International Inc.
477	IBM 4039 10R	Lexmark International Inc.
477	IBM 4039 10R Duplex	Lexmark International Inc.
425	IBM ExecJet II	Lexmark International Inc.
507	IBM LaserPrinter 4039 12L	Lexmark International Inc.
507	IBM LaserPrinter 4039 12R	Lexmark International Inc.
507	IBM LaserPrinter 4039 16L	Lexmark International Inc.
420	Impromptu Administrator Edition, Version 2.0	Cognos Corp.
420	Impromptu Enterprise Edition	Cognos Corp.
467	Inside MS-DOS 6	New Riders Publishing
461	Kodak ColorEase PS Printer	Eastman Kodak Co.
506	Kyocera Ecosys a-Si Printer FS-3500A	Kyocera Electronics Inc.
476	LaserMaster Unity 1200XL-D	LaserMaster Corp.
508	LaserMatrix 1000 Model 6	Output Technology Corp.
491	Learn at First Sight MS-DOS 6.0	maranGraphics
454	Mannesmann Tally MT360	Mannesmann Tally Corp.
454	Mannesmann Tally MT691	Mannesmann Tally Corp.
495	Mastering DOS 6, Special Edition	Syber
432	MediaMerge	ATI Technologies Inc.
404	Microsoft Windows Sound System, Version 1.1	Microsoft Corp.
496	MS-DOS to the MAX	Microsoft Press
478	NEC Silentwriter SuperScript 610	NEC Technologies Inc.
479	NewGen ImagerPlus 12	NewGen Systems Corp.
479	NewGen Turbo PS-660 B	NewGen Systems Corp.
479	NewGen Turbo PS-660p	NewGen Systems Corp.
427	Nokia Multigraph 445X	Nokia Consumer Electronics
455	Okidata Microline 395	Okidata
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455	Okidata Microline 590	Okidata
455	Okidata Microline 591	Okidata
480	Okidata OL400e	Okidata
480	Okidata OL850	Okidata
456	Output Technology EuroLine 800	Output Technology Corp.
457	Panasonic KX-P2023	Panasonic Communications & Systems Co.
457	Panasonic KX-P2124	Panasonic Communications & Systems Co.
457	Panasonic KX-P3123	Panasonic Communications & Systems Co.
457	Panasonic KX-P3124	Panasonic Communications & Systems Co.
457	Panasonic KX-P3624	Panasonic Communications & Systems Co.
481	Panasonic KX-P4440	Panasonic Communications & Systems Co.
481	Panasonic SideWriter KX-P5400	Panasonic Communications & Systems Co.
410	Paradox Version 4.5 for DOS	Borland International Inc.
410	Paradox Version 4.5 for Windows	Borland International Inc.
482	PC World DOS 6 Handbook, 2nd Edition	IDG Books
412	PC-Kwik Toolbox for Windows	PC-Kwik Corp.
408	PowerDAT Series 6000 Tape Backup System	Colorado Memory Systems Inc.
509	Printronic L3030 Duplex	Printronic Inc.
510	QMS 1725 Print System	QMS Inc.
510	QMS 2025 Print System	QMS Inc.
510	QMS 3225 Print System	QMS Inc.
462	QMS 420 Print System	QMS Inc.
482	QMS 860 Print System	QMS Inc.
464	QMS ColorScript 210	QMS Inc.
465	QMS ColorScript 230	QMS Inc.
419	QuickBooks for Windows, Version 2.0	Intuit Inc.
415	ReelMagic	Sigma Designs Inc.
493	Running MS-DOS, 6th Edition	Microsoft Press
483	Samsung Finale Hi-Res	Samsung Electronics America Inc.
421	ScanMan EasyTouch	Logitech Inc.
466	Seiko Instruments Professional ColorPoint PSH	Seiko Instruments USA Inc.
458	Seikosha SL-70	Seikosha America Inc.
458	Seikosha SL-75	Seikosha America Inc.
458	Seikosha SP-2450	Seikosha America Inc.
484	Sharp JX-9400	Sharp Electronics Corp.
428	SPSS 6.0 for Windows	SPSS Inc.
422	SST	Ask Me Multimedia Center
485	Star Micronics LS-5EX	Star Micronics America Inc.
447	Star Micronics SJ-144	Star Micronics America Inc.
413	STICA	Roland Digital Group
434	Sure!Maps 2.0	Horizons Technology Inc.
459	Tandy DMP 137	Tandy/Radio Shack Corp.
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467	Tektronix Phaser 200e	Tektronix Inc.
468	Tektronix Phaser 200i	Tektronix Inc.
469	Tektronix Phaser (laser)	Tektronix Inc.
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445	Ti microMarc	Texas Instruments Inc.
445	Ti microWriter	Texas Instruments Inc.
494	Using MS-DOS 6, Special Edition	Que
431	Voice Assist	Creative Labs Inc.
430	Vomax 2000	Macronix Inc.
451	winstall, Version 3.2	Knowledge Dynamics Corp.
488	Xante Accel-a-Writer 4000	Xante Corp.
468	Xante Accel-a-Writer 8100	Xante Corp.

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After Hours

GUIDEBOOKS: Adventures, America NavigaTour, Automap Road Atlas, California Travel, Global Explorer

CD-ROM PICK HIT: Picture Atlas of the World

GUIDEBOOKS

Five Desktop Travel Guides Help You Plan Your Vacation

BY PETER SCISCO

There are three kinds of travelers: those who know where they're going, those who are hopelessly lost, and those who never leave home. Whether you need help finding your way or you just want to indulge your desktop wanderlust, you'll find useful information in these electronic guidebooks.

Each of the five programs in this roundup has its strong point: Adventures takes you on exotic journeys around the globe, while Automap Road Atlas better suits the United States road tripper.

California Travel covers only one state in exquisite detail; Global Explorer lets you choose from over 20,000 points around the world. And if you want to create your own travelog in addition to planning your journey, only America NavigaTour will do. Bon voyage!

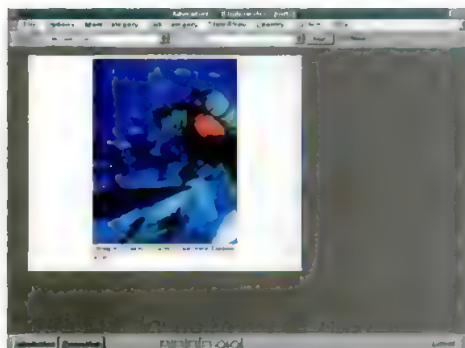
DEEP RIVER PUBLISHING INC.

Adventures

If your travels tend to the exotic, the CD-ROM-based Adventures is a must-have for your MPC-compliant PC. Whether you're planning a dive with sharks or a hike through the Tibetan mountains, this program helps put

together the practical details for even the most unorthodox journeys.

Organized in pragmatic but fascinating fashion, Adventures is more than an on-line picture book. It allows users to search, explore, or browse among worldwide expeditions by subject or place, and then plan a trip. The Main Category list groups excursions along thematic lines, from aerial adventures to underwater explorations. Brief textual introductions to specific tours are



Take an exotic trip through deserts, rainforests, or to the bottom of the sea with Adventures.

punctuated by color photographs and some brief videos.

For example, selecting Train Journeys from the main list opens access to several tours, ranging from a cross-continental rail adventure—rolling from Brazil to Peru—to a trek aboard the Trans-Siberian Railway. Each entry contains information about prices and accommodations, a

difficulty rating, a discussion of suitability for children, and a schedule. Telephone numbers and addresses are provided, and text can be sent to the Windows Clipboard for use in other documents.

If the destination is more important than the activity, you can select from the State/Prov menu (the 50 states, plus the Canadian provinces) or from the Country map. For international travel, the choices range from the expected (England's Lake District) to the exotic (Zambia's Zambezi River) to the unimaginable (Vietnam's Ho Chi Minh Trail). One shortcoming in the interface: A region's information can't be accessed by clicking on the map; instead, you must return to the program's series of drop-down menus.

The program's multimedia aspects round out the user's computer-bound travel experience, although some of the video clips look like old travelogs from 20 years ago. But the photographs are a gold mine and capture the essence of unique cultures, places, and journeys.

Adventures, \$49.95.

Requires: 4MB RAM, 2MB hard disk space, Super VGA display, Microsoft Windows 3.1 or later, MSCDEX 2.2 or later, MPC-compliant sound card, CD-ROM drive. Deep

River Publishing Inc., P.O. Box 9715-975, 565 Congress St., Portland, ME 04104; 800-643-5630, 207-871-1684; fax, 207-871-1683.

Circle 511 on reader service card

MEDIALIVE

America NavigaTour

America NavigaTour can be used to create compelling presentations for business, school, or home. The program restricts itself to parks, places of interest, tourist attractions, and major cities in the United States. But its ability to add notes, sound, pictures, and even movies makes America NavigaTour unique.

Beyond text and picture information, multimedia-enhanced information such as .WAV sound files, photos (like .BMP files), and AVI-format movies can be linked to the program's own database. You can add your own Photo CD images, though these must be converted to AVI format using a separate program.

These procedures are not for computer neophytes. When you're creating a presentation, the program uses a template to assist you in formatting and arranging the data, but to use America NavigaTour effectively, you need some background in pulling together presentations, and you have to know how to input and prepare the data properly.

NARROW SCOPE

While America NavigaTour is well suited for travelers who want to keep records of their



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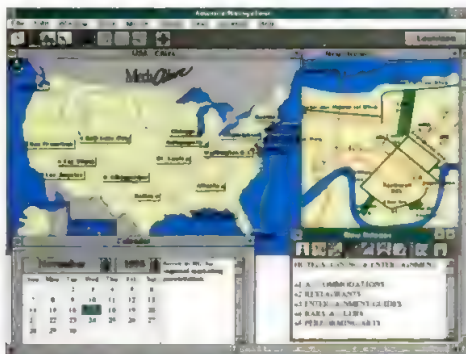
1/4 VS. FULL SCREEN Now you can get theater-quality video in a full-screen image for a realistic, movie-like experience.

America NavigaTour

journeys or create their own databases of information, it lacks the scope of Adventures and Global Explorer, which span the world. America NavigaTour's information is limited to the U.S.

Depending on the kind of information a prospective traveler is seeking, a toolbar at the top of the screen can be used to highlight the 50 states, 20 major cities, 28 national parks, and more than 20 entertainment attractions.

The state maps, which can each be brought to the screen by clicking on the state name on the U.S. map, show only interstate roads, capital cities, major population centers, and



America NavigaTour lets you plan your trip, then create your own travelogues.

some major tourist attractions. Some city maps can be brought to the screen by clicking on a city name on a state map—but the state map includes only the same cities that can be displayed on the national map.

This means there's not a lot of visual detail. For instance, if you select Kentucky from the national map, a small map of the state appears to the right of the national map. But that map shows only three things: the state capital (which is misspelled as *Frankfurt* instead of *Frankfort*), the city of Lexington, and Mammoth Cave, a

national park and the largest known cavern in the U.S. To get more information—for example, if you're planning a trip to the Kentucky Derby, in Louisville—you can access the information by clicking on a toolbar button. The button brings up a text box with more information about the state. Within such text entries, motivated travelers can find much more detailed information.

America NavigaTour's visual display of parks is heavily weighted to those west of the Rocky Mountains, while the tourist attractions are concentrated in the eastern half of the country. Information about Crater Lake and Olympic National Park is easily accessed from the map. Yet there is no

button for the Cape Hatteras National Seashore along the Outer Banks of North Carolina (the graveyard of the Atlantic), nor is there a button for the Cape Cod National Seashore along the coast of Massachusetts.

Gathering around the computer may lack the familial warmth of an old-fashioned slide projector show, and it isn't as convenient as watching a videotape. But with America NavigaTour and the right equipment, PC technology lets almost anyone be a film director and editor.

America NavigaTour, \$129. Requires: 4MB RAM, 10MB hard disk space, Microsoft Windows 3.1 or later. MediAlive, 766 San Aleso Ave., Sunnyvale, CA 94086; 408-752-8500; fax, 408-752-8501.

Circle 512 on reader service card

AUTOMAP INC.

Automap Road Atlas

When it comes to road trips, many of us spend more time in plotting rest stops than in freewheeling adventure. But if you're the kind of person who hears the call of the open road, Automap Road Atlas lets you be as flexible and as adventurous as you want.

Available in DOS and Windows versions, this program is designed to find the travel routes that suit you best and then calculate the time and the expense involved in reaching your destination.

Stick to the interstate, or get off the passing lane and take a roll down some two-lane blacktop. If time is on your side, ask the program to show you the most scenic route. If you have small kids in the backseat, you can skip the hill and dale and get directions for the shortest way to Grandma's house.

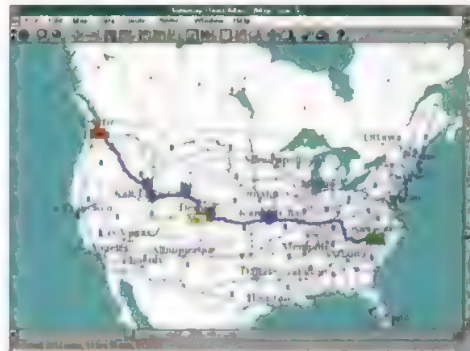
ALONG THE WAY

Automap Road Atlas can also show you the location of recreation areas, lakes, forests, mountain ranges—all the sights and places that make a road trip worthwhile. Getting to any of this information is as easy as pressing a button or moving a sliding bar.

A "Places of Interest" feature highlights special things to see along your route. You can set this option for a specified number of miles away from your route (say, anything within 30 miles of the road you're going to be traveling) and choose from natural fea-

tures, water features, parks, and mountains.

The program also allows you to define the roads you want to avoid. It even goes so far as to let you define your own driving style in terms of the speed you drive on different types of roads (interstate, urban, freeway, and so on). The default speeds of 55 mph and slower will certainly need



Define your driving style, and Automap Road Atlas finds the shortcuts and the scenic routes to your destination.

editing, however.

For help in figuring out your expenses, you can set the cost of fuel and the consumption rate for your car; the program will calculate how much gas you'll need and how much you'll pay for the trip. Each journey includes a start point and end point and accommodates up to four stops.

A copy of Automap Road Atlas might well make AAA Trip Tiks obsolete. Unlike a car club, it won't make reservations in a hotel or tow your car after a breakdown. But it does just about everything else.

Automap Road Atlas, Version 3.0 for DOS or for Windows, \$99.95; upgrade from previous version, \$39.95. Requires: 640K RAM (4MB for Windows version), 5.5MB hard disk space, DOS 3.0 or later or Microsoft Windows 3.0 or later. Automap Inc., 1309 114th Ave. SE, #110,

Automap Road Atlas

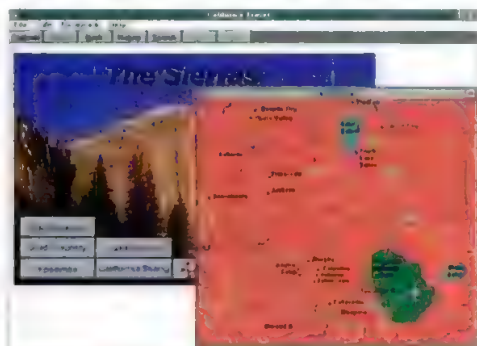
Bellevue, WA 98004; 800-440-6277, 206-455-3552; fax, 455-3667.

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EBOOK INC.

California Travel

It's called the Golden State, and it's the most populous state in the Union. It covers almost 160,000 square miles and includes shoreline, forests, mountains, deserts, and cities. From the tinsel of Hollywood to the rugged outback of the



From the rugged Sierras to urban L.A., *California Travel* helps you plan your Golden State vacation.

Sierra Nevada, California is the object of many Americans' wanderlust.

California Travel is a CD-ROM guidebook intended to provide an overview of travel destinations, from the urban sprawl of Los Angeles to the pleasing wine country and into the mountain ranges and sophistication of San Francisco. An introduction to the state's history and culture is enhanced with detailed travel information, including recommendations on restaurants, museums, shopping, amusement parks, and other points of interest. California Travel provides a glimpse of the architecture, the natural sights, and the culture that make California unique.

Exploring this CD-ROM

reference is much like reading a travel guide in book form, with differences both good and bad. The program keeps track of where you are and where you've been within the guide, and it also allows for quick searches for specific information by keywords. A separate photo gallery can bring more than 1,000 pictures to the screen, from aerial shots of vineyards to haunting sunsets near small adobe churches.

The guidebook metaphor points up some disadvantages. The screen layouts are not nearly as attractive and readable as the design of ordinary pages.

That criticism aside, the program does have its advantages. Detailed annotations can be made on each page and are signaled by a small paper-clip icon at the top left of

the screen. Bookmarks can be placed in the material; these will come in handy when your investigations are over and the real travel planning begins.

California Travel offers guidance to the natural wonders of the Golden State, and it adds historical and cultural notes to enhance the travel experience.

California Travel, \$29.95. Requires: 4MB RAM, Super VGA display, Microsoft Windows 3.1 or later, MSCDEX 2.2 or later, MPC-compliant CD-ROM drive and sound card. Ebook Inc., 32970 Alvarado-Niles Rd., #704, Union City, CA 94587; 510-429-1331; fax, 510-429-1394.

Circle 514 on reader service card

DELORME MAPPING CO. INC.

Global Explorer

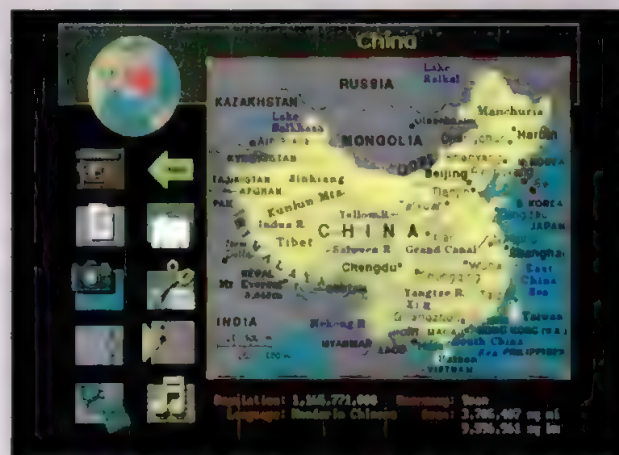
DeLorme Mapping Co.'s MPC-compliant CD-ROM Global Explorer is every bit as ambitious as Adventures but takes a slightly different approach in its presentation. Rather than focusing on formal guided trips and tours, Global Explorer makes the world its stage and allows users to zoom in on more than 20,000 places of interest; it's the richest database in this group of programs.

The program's excellent topographical maps are treasure troves of visual data. Each map displays icons that

provide access to information on tourist attractions, natural wonders, historical places, and other points of interest. You can move directly to those places, or you can choose to read a brief description before jumping to another spot.

Nonvisual navigators can use the program's fine search engine to move around the world, into countries, and around towns. Organized by place, country, and category, the database lets you narrow your search quickly, with an impressive level of detail. Planning to visit Oslo next spring? A search of museums there reveals the Viking Ship Museum, which houses three ninth-century ships, complete

■ CD-ROM Pick Hit: *Picture Atlas of the World*



Computer users who are content to explore the world from their desktops will appreciate the wealth of data on the National Geographic Society's Picture Atlas of the World. It brings to the PC screen the same high-quality images and text that make up the Society's magazine. The strength of this \$149.95 CD-ROM lies in its exceptional design. Movies, pictures, and short explanations are signaled on maps with camera and notepad icons. Terms that may require further explanation are highlighted in the text; clicking on those words brings up short definitions. The maps are easy to understand, and there is simple access to statistics. Movie clips and sound, including music and narration, play well under the LinkWay environment. (National Geographic Society, 800-368-2728.)

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Global Explorer

with artifacts from the period.

For travelers who are as interested in the journey as they are in the destination, Global Explorer's Air Travel option displays different air routes. Once you hit the ground, the program's Street Map option displays medium-detailed street maps for 100 cities around the world.

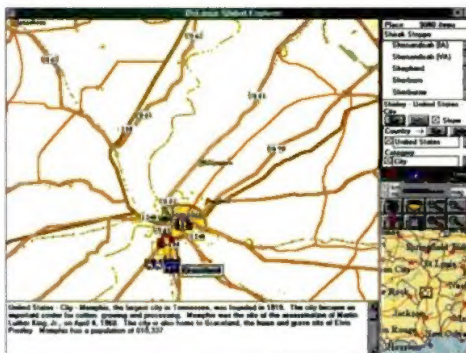
Supplementing Global Explorer's maps and database of points of interest, country profiles provide summary and statistical information. This data is organized in terms of population, government, economy, health, geography, military, wildlife, and even communications technology for modern travelers who must be plugged in at all times.

The main categories are further defined by subcate-

gories; for example, you'll find separate sections on age distribution and average marrying ages under *Population*. The program's well-designed interface lets you easily compare the statistical data between countries—a bonus for students.

NAVIGATION BY MOUSE

Navigating this world-in-a-computer requires some mousing skill, but getting the hang of zooming and panning takes only a few minutes of experimentation. Click on the map as presented on the left side of the screen and the clickpoint becomes the center of the map. If you need more detail, hold down the left mouse button and drag a zoom box across the desired area. To move to another point on the



With its rich database, Global Explorer gives you vast options for worldwide travel.

map, click again, or move the small "area of detail" rectangle that appears on a small map to the right.

Unlike Adventures and some other programs reviewed here, Global Explorer does not include photographs, sound effects, narration, music, or video clips. It trades those multimedia features for an extensive database of travel

information. The program will have to be supplemented with a more intensive guidebook before you head out, as it does not include information about accommodations, transportation, or cultural differences. But for planning and seeking unique destinations, the program's breadth and depth are hard to match. □

Global Explorer, \$169.

Requires: 4MB RAM, 3MB free disk space, Microsoft Windows 3.1 or later, MSCDEX 2.1 or later, ISO 9660-compatible CD-ROM drive. DeLorme Mapping Co. Inc., P.O. Box 298, Lower Main St., Freeport, ME 04032; 800-452-5931, 207-865-4171; fax, 207-865-9291.

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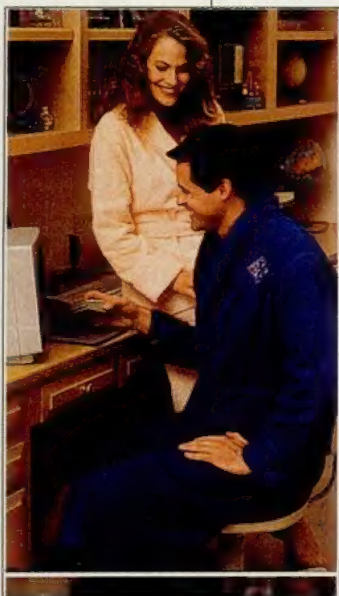
MOVING?

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Abort, Retry, Fail?

THE LIGHTER SIDE OF PERSONAL COMPUTING

By Don Willmott



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(Land's End catalog.)

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Zone 1-2-3

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Inquisition.

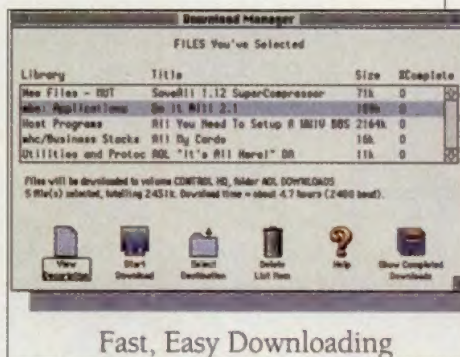
Redefining Junk Mail

"If for some reason your game documentation is lost or destroyed, it can easily be fixed. Send Sierra your game 'Disk #1' (cut 5.25-inch disks in half to fit the envelope), include \$5 or \$10. . . Call Sierra's Customer Service first (They like to talk). Sierra will send you new documentation for your game and your original 'Disk #1.'"

—INTERACTION MAGAZINE

Aloha Oy!

Faithful reader William Fay received an exciting offer from Symantec: Buy Symantec C++ and get two airline tickets to Honolulu, Hawaii. Great deal, but there's one problem. Mr. Fay's business, Hawaiian Electric Co., is based in—you guessed it—Honolulu. And remember: Symantec sells databases.

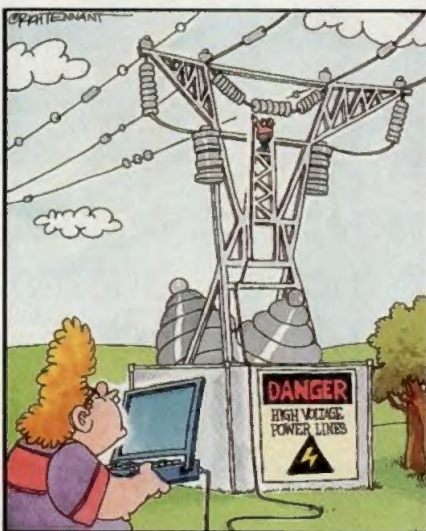


Look closely
at the "fast"
download time.
(America Online
ad.)

No Need to Apologize

"Due to the memory shortage, we cannot estimate the memory price for August. . . Sorry for the incontinence."

—NETIS TECHNOLOGY LETTER



Richard Tennant

If your entry is used, we'll send you \$50 and a PC Magazine T-shirt. Send your entries to Abort, Retry, Fail?, PC Magazine, One Park Ave., New York, NY 10016-5802. Winners this issue: Quinten Lance Corbenic, Martin Dolphin, William Fay, F. S. Mueggler, Michael S. Vaughn, and Kenneth Walenga.

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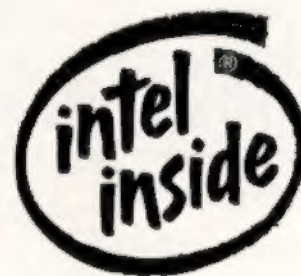
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